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ENGINEERING TRAINING.

OUR readers have already been informed of the decision which has been arrived at by the Manchester City Council as to the class of student who is, in the future, to be admitted to the Municipal College of Technology. This famous institution, which, so far as the training of engineers is concerned, has no compeer outside London, has hitherto been open only to students of matriculation standard, who intend to take a course of training in engineering culminating in a university degree, the College being itself the Faculty of Engineering of the University of Manchester. The training can be carried beyond the point at which a degree is granted, and there are unexcelled facilities for post-graduate work.

As to these facts there can, we believe, be no dispute. Our summary is very incomplete, but we wish to bring out the point that here is an institution which is capable of doing, and has already done, work of a character which cannot be carried out by any other educational centre in the North of England.

At the suggestion of the Education Committee, as we recently stated, the Corporation has now resolved to admit pupils whose intention is to take a course of training such as can be obtained in any one of half a hundred secondary schools and technical colleges in Lancashire and Yorkshire. To this end it has limited the number of students of degree courses, who are to be admitted to about one-third of the available accommodation, and the remainder is to be thrown open to those who cannot, and in most cases do not wish to, make full use of the potentialities of the situation in which they will be placed.

We understand that the College derives its revenue from four sources: The fees of the students, the rates of the city, the Board of Education grant, and the Government grant for degree students. The government of the College is vested in the Manchester Corporation, and it appears to be felt by some that the benefits largely paid for by the citizens should be reserved for the sons and daughters of the citizens. Some mention has been made of "foreigners," by which term is meant certain British subjects from overseas, and a few members of the population of allied countries. Objection has been raised to the admission not only of these persons, but of students from neighbouring towns in Lancashire.

One would think it would be quite clear, after a moment's reflection, that the benefits derivable from the possession of the College are not restricted to the educational facilities thereby provided, important as these are. There is another, and, in our opinion, a greater advantage, arising out of the world-wide advertisement given to Manchester engineering by the

men and women who derive their knowledge from a Manchester institution. Further, there is a constant stream of able engineers in embryo issuing from the College, who can be, and are, to a very large extent, absorbed into Manchester industry, which is constantly in need of them.

Manchester engineering, and, indeed, British industry generally, need the best brains, trained in the best possible manner, to the greatest possible extent; and since the best brains do not grow, like cabbages, all in one patch, they must be obtained wherever they are available, and trained wherever the requisite facilities can be given. At present the resources of our Universities and Engineering Colleges are strained to the utmost to provide accommodation for even a portion of the candidates for admission to their courses; the imperative necessity for acquiring the best possible training is increasingly gaining popular recognition, and in the national interests it is desirable that our educational equipment should be utilised to the best possible advantage. It is for this reason that the reversion of the Municipal College of Technology to the status of a technical "school," which it so recently repudiated (March, 1918) on the ground that it was of University rank, is a matter for the keenest regret.

For the moment, unfortunately, the narrower view has prevailed, but we do not believe it represents the opinion of the majority of the ratepayers of Manchester. We have sufficient faith in the far-sightedness of this great business community to believe that when the far-reaching effect of the new restrictive policy is more fully realised the mistake will be remedied, and that when the time arrives the Labour members, who claim to have the interests of the less wealthy citizens at heart, will be among the first to agree to, if they do not actually suggest, its rectification. The Labour Party has a full appreciation of the advantages of education.

We purposely refrain from any comments on the unfortunate differences between the Education Committee and Mr. J. C. Maxwell Garnett, the Principal of the College, which have culminated in his resignation, as we regard the future of the College as of the greatest importance, in which view we are sure Mr. Garnett would concur.

Workmen's Compensation.

In the earlier months of last year a committee was appointed by the Home Secretary to inquire into the working of the present system of paying compensation to injured workmen, and to report whether it would be desirable to establish a State system of accident insurance, and also whether legislation is required to remedy defects in the present law which experience has disclosed.

The Committee, which was presided over by Mr. Holman Gregory, K.C., M.P., has now reported, and very far-reaching recommendations have been made.

The payment of compensation to workmen in case of injury, and to dependents in case of death, has now become so much a matter of routine in business life that it is a little difficult to realise that until the year 1846 the family of a person killed in the course of employment had no legal remedy against an employer.

In that year the Fatal Accidents Act was passed, better known as Lord Campbell's Act, which permitted the employer to be sued in case of pecuniary loss by death if the death were due to default of the employer, and an employer thereby became bound to take reasonable precautions, but the employé was supposed to run the risks of common employment, and the employer was not responsible in case of injury caused by another's negligence.

In 1880 the Employers' Liability Act was passed, and further legislation followed in 1897, 1900, and 1906.

In the matter of workmen's compensation the war has, as in so many other matters, brought about the necessity from time to time for consideration of the question of compensation in view of the decreased purchasing value of money, and in 1917 the maximum in weekly compensation was increased from £1 to 25s., and in 1919 to 35s. per week.

The present report proposes to bring within the scope of the Acts large new classes of persons (including non-manual workers earning up to £350 per annum), and largely to increase benefits, the maximum liability in case of death to be £800, as compared with £300 at present, whilst a maximum liability of two-thirds the weekly earnings with a maximum of £3 per week is now suggested in case of accident.

It is proposed to appoint a Commissioner to act under the Ministry of Health, whose duty it will be to work out a scheme to provide any medical and surgical attendance required in addition to that already available under the National Health Insurance Acts.

The Committee points out that the annual premiums of 65 insurance companies dealing with workmen's insurance exceed £5,000,000, and that in addition 50 mutual indemnity associations pay about two million pounds per annum in compensation.

Should legislation proceed on the lines suggested the burden on employers will necessarily be increased, which must in turn be passed on to the consumer, although this will be partly met by the larger premiums now payable in consequence of the increased wages bill. It is proposed that there should be State supervision of the rates of premium, and the heads of a working agreement have been made with the association which represents insurance companies whereby not more than 30 per cent. of the premium income is to be expended in profits, management, expenses, and commission.

The Commissioner is to approve maximum rates of premium, and it is suggested that discounts should be allowed where satisfactory safety devices are installed, a move in the right direction, and following the now well-established method of the fire offices with respect to fire prevention.

Other important suggestions are made, and a Bill on the lines proposed will, when brought before Parliament, merit the closest attention from all concerned.

The Electrification of the Italian Railways.

The interpellation raised in the Italian Senate on July 6th, by Senator Mengarini, has somewhat cleared the air concerning the intentions of the present Government in the matter of the conversion of a considerable mileage of the State railway system to electric traction. The Senator, who at some length pressed for an acceleration of the scheme, pointed out that, according to the calculations of the State Railway authorities, the electrification of the 2,600 miles decided upon would represent an annual saving in coal amounting to 1,786,000 tons, or an economy of from 800 to 900 millions of lire on the basis of the present prices of coal. The method proposed by Minister Peano for carrying out the work was for the State Railway authorities to proceed directly with one group of lines with the aid of the 800 millions of lire provided by the De Nava and De Vito decrees, to entrust a second group to private enterprise, and postpone a third to the future. In the opinion of the Senator, however, the State Railway authorities were not in a position to assume such a grave task. The only solution possible was to empower the railway authorities to construct, or re-construct, the lines for the 2,600 miles, but to entrust to private industry all the installations, together with the hydro-electric generating stations, transmission lines, and sub-stations. It would be possible in this way to electrify about 300 miles per annum. Amid loud applause the Senator concluded that the problem could only be solved economically and completely within a brief period, by means of the fullest co-operation of private firms with the State.

Minister Peano, who agreed with the necessity for increased activity in the matter, stated in reply that a great step forward was proposed by the Bonomi decree then before the Lower Chamber. It was arranged that the services which superintended all derivations of public waters

and mountain basins, all drainage works, &c., should be combined to examine and solve the problem completely. Of the provisions in the decree for facilitating the construction of hydro-electric stations, that which granted a subsidy of 40 lire per horse-power was immediately to be brought into operation. As to the suggestion that the continuous-current system should also be adopted, the Minister remarked that the three-phase method had proved successful in Upper Italy, and it was therefore intended to apply it also to the lines more urgently needing conversion, while recourse might be had later on to another system if shown to be superior. The Minister agreed that it would be advantageous to utilise private enterprise, leaving to the State the construction or reconstruction of the lines; but the question could not be settled or prejudged at that moment. It was also necessary for the Department which must supervise all the works to be able to carry them to a conclusion, and when reorganised it would be able to enter into agreements with private companies. In conclusion, the Minister referred to the advantage of the electrical machinery being provided by the national industry.

The Apprenticeship System.

That a youth who is going to earn a living as an engineer by the exercise of initiative and intelligence must necessarily pass through a prolonged theoretical and practical training is an axiom which cannot be challenged. It used to be held that a youth who was to become an artisan, and earn a living by his handicraft, must needs undergo an equally long apprenticeship—but the war has completely exploded that idea. The wonderful results obtained by the intensive training of men and women, boys and girls, for service in munition factories, proved to demonstration that, with the help of skilled instructors and appropriate apparatus, the degree of manual skill necessary to perform efficiently a limited range of operations could be imparted to the average learner within a few months, the period required depending upon the class of work, but seldom extending to six months.

Under modern conditions, the worker who has to be expert at more than a few definite jobs is rarely called for. An adequate degree of skill to justify the employment of a young man as a turner, planer, wireman, armature winder, or instrument maker can unquestionably be imparted to him within six months at the outside; if he take longer, he is not adapted to the class of work, and should be tried on something else. Of course, his skill will develop with constant practice, and, in particular, the speed of his work will increase; but our point is that, *with suitable instruction* in lieu of apprenticeship, the improver stage can easily be attained in a few months.

Abundant evidence of this fact was forthcoming during the war; further evidence was afforded by the Exhibition which closed yesterday. That such excellent work could be turned out by men—and disabled men—who had only been a few months in training, could hardly be credited; but the facts were indisputable, and the same phenomenon was manifest not only in electrical work, but also in boot-making, coach-body building, cabinet-making—anything you like.

Under existing circumstances, of course, the apprenticeship system cannot yet be dispensed with, but it is clear that a long apprenticeship is not necessary provided that efficient instruction is substituted for it. This so-called system has been responsible for the waste of a great deal of time. As the new Education Act makes its influence felt, the average age of apprenticeship will tend to rise, and the duration of the service to shorten, while systematic education on broad lines will occupy a considerable portion of the time most profitably, and will afford an opportunity for the keener intellects to reveal their fitness for higher training. But the old-fashioned "system" of apprenticeship is obsolete.

The Lighting Question in Paris.

As is fairly well known, a monopoly of the public supply business in Paris is held by the Compagnie Parisienne de Distribution d'Electricité, while in the suburbs a similar position is expected to be assumed by the Union d'Electricité, a comparatively new undertaking which is gradually grouping around it all the companies in the environs, and at the same time is proceeding with the erection of a super-station at Gennevilliers. During the course of the War, the demand for energy for power purposes on the part of industrial works engaged on contracts for the national defence in the region of Paris gradually increased until, instead of being merely complementary to the lighting supply, it became three times greater than the latter, although regard must be had to the restrictions imposed on lighting and the exodus of some of the population during part of the period of the War. The natural reaction followed after the Armistice, and it is thus found that while the consumption for power purposes in 1919 met by the Compagnie Parisienne decreased by over 45,853,000 KW.-hours, as compared with 1918, the quantity used for lighting services experienced an increase of 24,787,000 KW.-hours. In their report for 1919, the directors mention that it has become more and more difficult to procure machinery, cables, transformers and meters required for the development of the undertaking, although the number of new connections established last year affords confidence in the future. The net profits in 1919 were considerably less than in the preceding year, but have yet permitted of the payment of a dividend of 10 fr. per share. A new tariff came into operation on May 1st, 1920, and the company's partners—the Municipal Council of Paris—decided that the proceeds resulting from the amount of the increases then sanctioned should be placed to a special account—its disposal to be determined at a later date. In the case of the Union d'Electricité, it appears that contracts have already been allocated for the delivery of the machinery for the super-station previously mentioned. The report of the directors of this company refers to the agreements concluded with other supply companies in the vicinity of Paris, and also admits a decline in the production, as compared with the previous year, owing to the same reasons as apply to the Compagnie Parisienne. As the undertaking is only in an initial stage of development, it is yet too early for sufficient profits to be obtained to permit of any distribution among the shareholders. The company is not under the control of the Municipal Council of Paris, whose share in the gross receipts of the Compagnie Parisienne in 1919 increased by 1,246,000 fr. over 1918, despite the fact that the company's net profits decreased by 1,817,000 fr. in the two years respectively.

Wolverhampton Extensions.

We are pleased to be able to give a description in this issue of the important extensions which were carried out at Wolverhampton Corporation Electricity Works by the borough electrical engineer, Mr. S. T. Allen, during the war, under circumstances of extreme difficulty, of which only a portion are known to the public. The original station, dating from 1895, bore abundant evidence of its development through successive electrical epochs, with the corresponding changes in technique; without interrupting the supply, it has been rejuvenated and transformed into a modern installation in conformity with the latest practice, working on very economical lines, the reduction in fuel consumed representing a saving of over £20,000 during the year. Moreover, the large extensions have been carried out at a cost of only £16 a kilowatt. The undertaking is, therefore, in a relatively favourable position, and as it will form an important factor in the scheme for the North-West Midland electricity supply district, which is now under consideration, its future is assured.

Yesterday the Electricity Committee paid a formal visit to the power station, to inspect the extensions, which have now been completed.

WOLVERHAMPTON ELECTRICITY WORKS EXTENSIONS.

Amongst the many extensions of electricity works that took place during the War, those which were carried out by the Wolverhampton Corporation Electricity Department are of exceptional interest, because they involved a drastic reconstruction of the buildings, the substitution of new boilers and generating sets for the plant previously installed, and the complete reorganisation of the whole installation without interruption of the supply. At the same time, the system of generation was changed from low-pressure D.C. and high-pressure A.C. to alternating current alone, transformed down for the consumers in the outer areas and converted to D.C. for the original network and the tramways. By the courtesy of Mr. S. T. Allen, M.I.E.E., who was appointed borough electrical engineer and manager in 1913, we recently enjoyed the privilege of visiting the electricity works and obtaining particulars and photographs of the equipment, which are embodied in the following article.

In 1914 the plant installed had a total output capacity of 7,200 KW., partly three-phase and partly direct-current; the total capital expended on the undertaking was £287,972, and the total connections amounted to 11,349 KW., including motors of 8,764 H.P. Supply was given to consumers at 220 and 440 volts D.C. and 230 and 400 volts A.C. In addition to a number of high-speed reciprocating-engine D.C. sets, there were two Willans-E.C.C. turbo-alternators of 1,000 KW. each, and one of 2,000 KW. The boilers in the old boiler-house were of three types—Economic, Lancashire, and Babcock & Wilcox, working at 160 lb. per sq. in., with chimney and induced draught. Condensing water was derived, as at present, from the adjoining canal, which also served for the transport of coal. Before the outbreak of war plans had been prepared for the reconstruction of the power station and extension of the plant, which had actually been commenced. The rapid increase in the demand for power due to the war rendered an immediate addition to the plant a matter of urgency. A Willans-Siemens 4,000-KW. turbo-alternator had already been installed by Mr. Allen on a space which was fortunately available at the extreme end of the existing station, and an order had been placed for a 5,000-KW. set.

It will be noticed in figs. 1 and 2 that the roof at one end of the station—over the smaller generating sets—is lower than in the main building, and that a travelling crane runs on a correspondingly lower track; the original roof of the whole of the engine room was at this height, and the crane track ran from end to end at the level indicated in the illustrations. It was necessary, in order to accommodate the new generating sets, to raise the walls, provide a new crane gantry, and construct a new roof without interfering with the running of the plant then installed, and this was successfully accomplished; the old roof, which was a wooden structure, and therefore a constant source of danger from fire, was afterwards removed, a steel-framed roof having been erected over the smaller turbo sets. The switchboards, which formerly stood on the floor along the right-hand wall shown in fig. 1, were simultaneously removed, and the D.C. board was re-erected in an annexe to the engine-room, together with entirely new switchgear for the A.C. plant. The erection of the new generating sets was then put in hand, and in the meantime a new boiler house and cooling towers were built. What all this meant to the chief engineer (who was responsible for the whole of the designs in addition to the execution of the work, no consulting engineer being employed) can be better imagined than described. Mr. Allen pays a tribute to Mr. E. Forder, the station superintendent, and the various officials who so nearly discovered perpetual motion in themselves during this trying period. The increase in the height of the station buildings necessitated the erection of new walls outside the old ones, the preparation of new foundations underneath the footings of the existing walls and columns, and the heightening of the columns to carry the new crane gantry and the upper walls

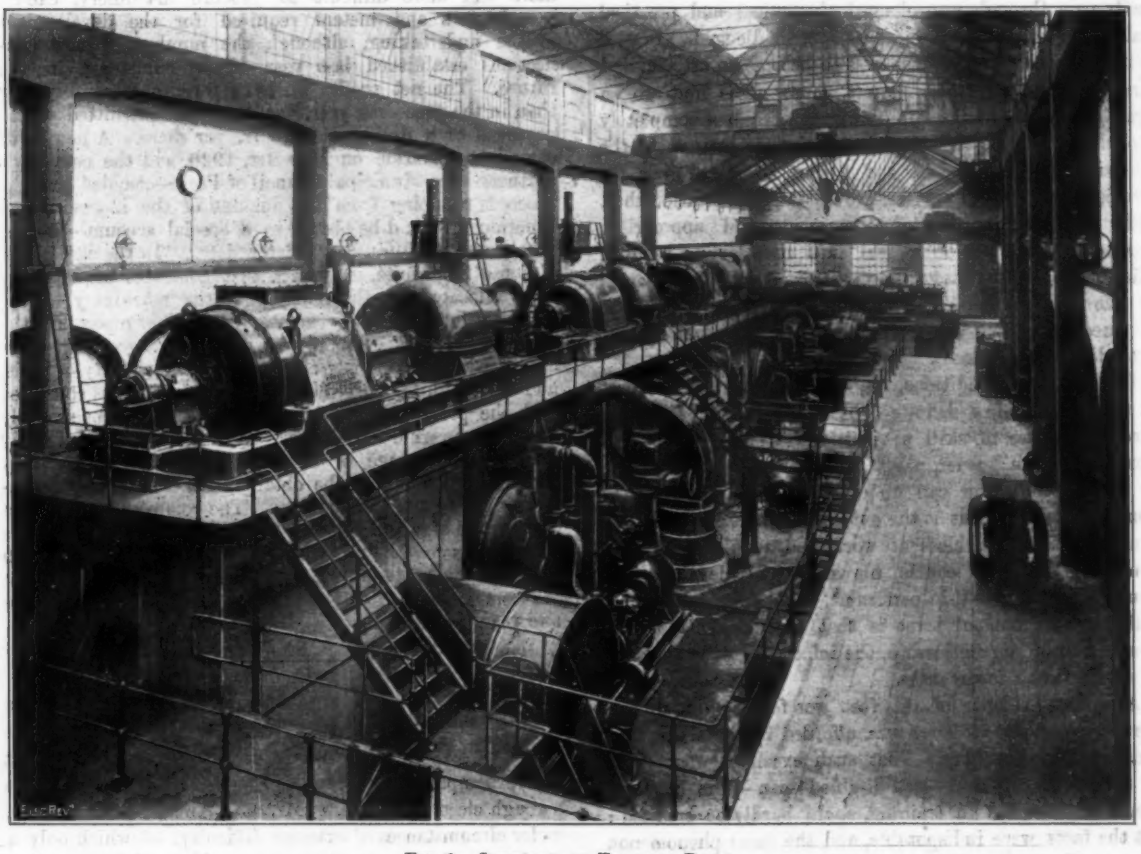


Fig. 1.—Interior of Turbine Room.

and roof. The new columns, of reinforced concrete, were tied into the existing columns, and the completed structure formed a very satisfactory building, with ample strength to meet all requirements. A special feature of the design is the provision of abundant side lighting from the windows above the crane gantry, in addition to the lighting from the roof, good lighting being in the opinion of the engineer a most important factor in the efficient maintenance of the plant.

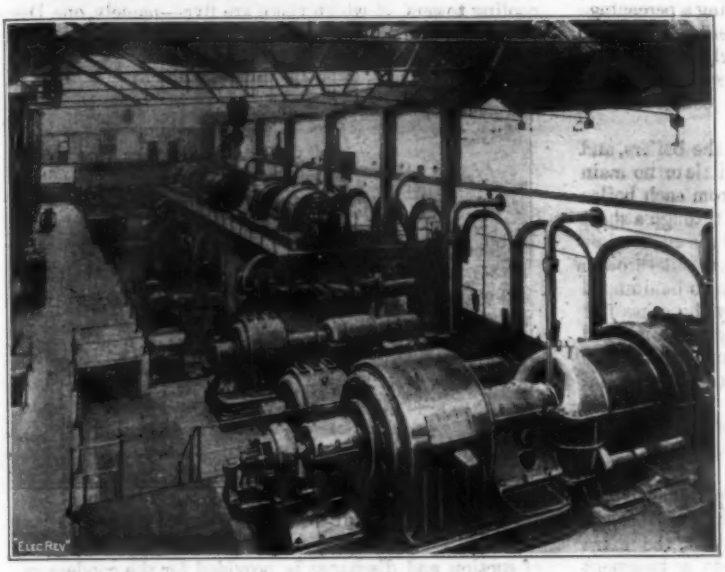


Fig. 2.—Another View of the Turbine Room.

A noteworthy feature of the generating plant is the total absence of a basement. It is a cardinal feature of Mr. Allen's policy to have every item of the plant fully exposed to view and completely accessible; the generating sets are therefore mounted on high foundation blocks, and the auxiliary plant—condensers, pumps, and air filters—stands in the open on a lower floor (fig. 3), where it is readily handled by the crane and is constantly under observation. No perceptible vibration results from the use of the high pedestals; tests have been applied to every part of the building which prove this statement.

The installed capacity of the plant is now 23,500 kw.—three times the pre-war value; the total connections this year amount to 21,381 kw., including motors of 18,975 h.p., and a tramway load of 750 kw. The generators operate at 6,000 volts, 50 cycles, three-phase, and the supply is given on the four-wire system at 230 and 400 volts, part being converted as mentioned above to d.c. for the old network and the tramways.

The large generating sets comprise two Willans-Siemens and one British Thomson-Houston turbo-alternators, of 5,000 kw. each, running at 3,000 r.p.m. The condensing plant for the former sets was made by Messrs. Willans & Robinson, Ltd.; the third condenser was supplied by Messrs. W. H. Allen, Son & Co., Ltd., but in each case the Jose-Müller patent air-extraction plant, manufactured by Messrs. Willans and Robinson, Ltd., was installed, operated on the "shunt" system. A description of this system was given in the Electrical Review of September 26th, 1913; the air is extracted by an ejector through which a portion of the circulating water is passed, while the condensate is removed by a separate centrifugal pump from the bottom of the condenser. This system has proved highly satisfactory. The condensate is pumped up to Lea recorders, whence it gravitates to the hot well. The temperatures of the steam entering and leaving the turbines, of the condensate, &c., are measured with the Cambridge Scientific Instrument Co.'s apparatus with indicators on switchboards. The wet-air filters were supplied, one by Messrs. Heenan and Froude and two by Messrs. Grice, and are situated close to the foundations of the generating sets; channels are provided in the concrete pedestals, through which the heated air is carried away, being led into the boiler-house by sheet iron trunks. The travelling crane was supplied by Messrs. Herbert Morris, Ltd., Loughborough.

Turning now to the steam-raising plant, we find that this also was completely reorganised and extended during the war. The boiler-house extension was built of reinforced concrete filled in with brick, and was so designed that the firing floor was 13 ft. above the ground level, so that here again there was no basement. The Lancashire and Economic boilers were removed; 4 Stirling boilers were fixed in their place, and a further five new Stirling boilers were installed, each rated at 40,000 lb. per hour (fig. 6). These were fitted with Underfeed stokers, and provided with both forced and induced draught, the whole making an extremely happy combination, for during the war the supply of fuel was of the most diversified character, to say the least, yet it was always possible to adjust the conditions so as to secure most economical results. Amongst the varieties of fuel dealt with have been Durham gas coal, anthracite, and coke-oven refuse—wholly different in characteristics, calorific value, and ash content, and liable to follow one another in any order without warning—yet with the balanced draught and the "A" type stoker of the Underfeed Stoker Co., Ltd., Mr. Allen has been able to burn anything that has come along, and absolutely without the production of smoke.

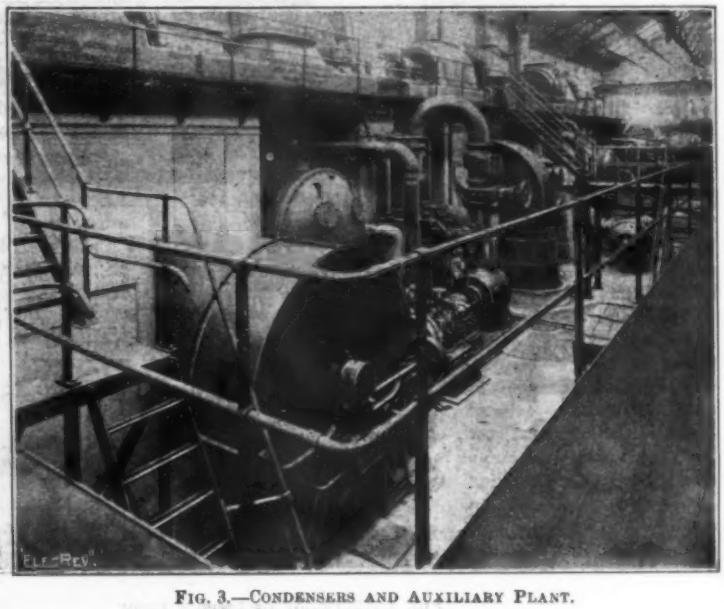


Fig. 3.—Condensers and Auxiliary Plant.

The furnaces are of the "Dutch-oven" type, combustion being practically completed in the projecting furnace before the hot gases enter the boiler setting and come into contact with the tubes. This is the secret of smokeless combustion, and is in exact accordance with the principles which we continuously pressed upon our readers' attention 15 to 20 years ago, when water-tube boilers were coming into general use with furnaces which could only be described as soot-producers. The combination of induced draught and forced draught enables the conditions of combustion to be regulated to a nicety; the air is drawn from a partly

open chamber into which the hot air from the turbines is discharged, so that the fans, while propelling all the hot air into the furnaces, are free to draw additional air from the stokehold. Thanks to the high degree of conservation of heat in the engine-room and boiler-house, it is actually on record that during the winter artificial heat had to be provided in the stoke-hold, to enable the firemen to attend to their duties in reasonable comfort! Simmance CO_2 graphic recorders are constantly in use, showing a percentage generally in the neighbourhood of 14 per cent. CO_2 in the flue gases, and the coal and water are regularly analysed and tested in the chemical laboratory. The saving in fuel consumption due to the policy adopted is conservatively estimated at a value of £20,000 per annum.

The Green economisers are situated above the boilers, and the course of the gases is such that there is little or no main horizontal flue, the gases passing upwards from each boiler to the economiser, through the fan, and out through a short steel stack. The soot and dust scraped off the economiser tubes fall into sloping shoots, which carry them out through the wall of the boiler house, and enable them to be dumped into trucks without any handling. Similarly the ashes fall from the grates into hoppers from which they are discharged by gravity into trucks running on the ground level. The trucks are bottom tipping, and are lifted off the trolleys and dumped into the ash hopper.

The ashes are removed in the Corporation's own electric trucks, of which it has three of 3½ tons load each, two of 2½ tons and one of 1 ton.

Considerable savings are effected by keeping the whole plant above the ground level; in the case of the ashes, of which about 25,000 tons are produced per year, the extra handling necessary if they were discharged into a basement would cost approximately £7,000 a year. It would also be necessary to pump out water accumulating from seepage into the basement. The greater facilities for inspection and supervision when the plant is above ground materially reduce the cost of maintenance.

The Corporation has its own wharves and a fleet of barges, from which the coal is lifted by grabs and conveyed by a low-level telpher system to a hopper, whence it is carried up over the bunkers by a high-level telpher, a complete duplicate system being provided, so that there is no risk of stoppage of supply due to a breakdown. There is also a coal-storage yard on the other side of the canal, adjoining the railway, and it is intended ultimately to extend the low-level telpher to this yard.

The bunkers over the boiler-house are capable of holding about a fortnight's supply of fuel, in addition to some eight weeks' supply stored in the coal yard. The coal is gauged to the stoker hoppers—where the fuel, as here, is continually changing, it is useless to weigh it out. The coal is, however, weighed by the colliery company and the canal company, and is checked by the tare of the barges, which are practically calibrated for this purpose.

Condensing water for a load of 5,000 KW. is obtained from the canal through grids and two revolving screens, one by Messrs. Waller, of Stroud, and the other of the Brackett type. The main cooling, however, has to be done with cooling towers, of which there are five—namely, one Davenport, two Premier, and two Film (fig. 7). A duplicate system of suction and discharge is provided for the condensers, the former consisting of an open trench under the floor of the engine-room, while the discharge is effected through pipes. The make-up water is derived from the town mains, and is softened by a Royle pressure purifier.

Fig. 5.—Sub-station at Power House.

There are five turbine-driven feed pumps—three by Messrs. Weir & Co., one by the British Thomson-Houston Co., and one by the Rees Roturbo Manufacturing Co.—and four electrically-driven Rees Roturbo pumps. The Weir pumps are rated at 28,000 lb. per hour, and the exhaust steam is used to heat the feed water. The circulating pumps were made by the Rees Roturbo Mfg. Co., Ltd., and Messrs. Mather and Platt, Ltd., and are electrically driven.

Fig. 4.—Interior of Switch Room.

When the station was reconstructed, the existing cubicle high-pressure switchgear was scrapped and the debt paid off, Reyrolle iron-clad switchgear being substituted; the old D.C. switchboard was modernised, and both sets were installed in an annex, from which the whole station is controlled. Illuminated signals are provided in the turbine-room, and a hooter for calling the attention of the drivers; each order is acknowledged by the driver, by means of a hooter.

We give a view of the interior of the switch-room, fig. 4, showing the A.C. switchboard on the left, the switches themselves being on the other side of the wall. The D.C. busbars have been separated, one pole being placed overhead and the other under the floor, with great advantage to the personnel. An adjoining sub-station, shown in fig. 5, is controlled from this switch-room; the sub-station contains converter and booster plant, having a total capacity of 4,150 KW. There is a basement under this sub-station,

and by mounting the transformers half-way between the two floors, a useful cooling current of air is maintained round them.

A large Chloride battery, capable of giving 5,000 amperes for an hour, is kept floating on the D.C. mains, and serves as a reliable stand-by for the auxiliaries. It is used to help to deal with the peak load in winter, and has often proved of great value in emergency, being capable of giving 10,000 amperes at 500 volts for a short time.

There are 22 transformer sub-stations, equipped with Berry, Brush, and Ferranti transformers, and switchgear by Messrs. Reyrolle, Ltd., and Messrs. Ferguson, Pailin, Ltd. There are also five rotary converter sub-stations, and three balancing sub-stations. A 500-KW. steam turbo-alternator is installed in a destructor at the other end of the town, steam being paid for at so much per unit, and a second set is on order.

The mains are of the paper-insulated lead-sheathed type, some laid direct and some on the solid system; the feeders are drawn into Sykes ducts for the most part. The heavy feeders are protected on the split-conductor system.

The Corporation possesses full powers for wiring, &c., and has a large installation department, which has proved a great help to the undertaking—and incidentally to the contractors, with whom the department's relations are very satisfactory. The fact that in a few years the number of local wiring contractors has increased from four to 20 shows that there is no question of their existence being threatened by the municipal business, which hands on to them a great deal of work, charging only a small commission on the contract price, to cover the cost of specification and inspection. Some 100 consumers are at present awaiting connection, which is delayed by the shortage of cable. The heating and cooking load is developing faster than it can be dealt with—faster than the power load.

The annual output before the war was 13 million units; the highest figure reached during the war was 34 millions, but last year it was down to 18 million units. The pre-war income was £55,834; in 1918-19 it amounted to £171,278, the highest value recorded, and the capital outlay during the war was increased to £581,366. The

Fig. 6.—The New Boiler House.

undertaking is fortunate in that the important extensions above described were carried out at a cost of only £16 per KW.

When Mr. Allen came into office in 1913, he realised that, in order to make satisfactory provision for the future, broad views were necessary, and his reconstruction plans were prepared on that basis. It was largely owing to the fact that these plans were all ready and in course of execution that the Government agreed to the continuation of the work of conversion, and, in fact, greatly accelerated it by affording special facilities.

In conjunction with the reconstruction of the plant, the undertaking had to be radically reorganised, a process in which Mr. Allen was greatly aided by the loyal assistance and administrative ability of his secretary, Mr. C. W. Charlesworth. The whole administration was remodelled to suit the new conditions; the offices, formerly situated at the works, were brought to a central position in the town, and each department was provided with separate rooms and offices, with excellent results. In the same building is accommodated a showroom with large windows facing two

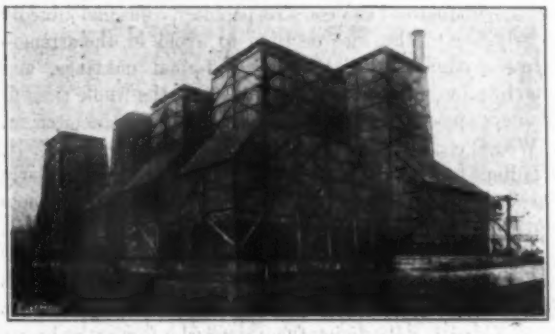


Fig. 7.—Cooling Towers and Canal.

streets, which affords ideal opportunities for the display and demonstration of all kinds of electrical apparatus. Here it is intended to provide instruction in the use of electric cooking, heating, and labour-saving apparatus—an essential to the complete success of electrical methods.

During the War, the use of electricity in Wolverhampton underwent a great increase; Mr. Allen, who was on the Development Committee, and had plans made showing all the sites available for works, was instrumental in filling up two-thirds of them with new industries of very varied characteristics, including some very large undertakings. A phosphorus factory absorbed a load of 8,000 KW. continuously, and a zinc production scheme was allotted to Wolverhampton, but this did not mature in time.

The position of Wolverhampton with regard to the national scheme of electricity supply is of more than ordinary interest. The delimitation of the North-West Midland area, in which it is situated, has been under consideration for some time, and is now approaching completion. A Committee of Engineers has drawn up a scheme to form the basis of a joint undertaking, under which Wolverhampton, besides taking part in the generation of electricity, will be an interchange station for some 80,000 KW. The Corporation's electricity department has for some years been amicably working in conjunction with the Midland Electric Power Co., with which it is on the best of terms, as well as with other neighbouring undertakings, and a 33,000-volt underground main is about to be laid between the Wolverhampton works and the company's power station at Ocker Hill; a similar main will be laid to Cannock, the distance in each case being about 8 miles. The step-up plant will comprise six single-phase transformers in two sets of three, each set being rated at 6,000 K.V.A. The supply will be controlled entirely on the 6,000-volt side. The trunk mains will be provided with the Merz-Beard pilot sheath method of protection.

The town is in an exceptionally favourable position for industrial development, being conveniently situated outside the congested area of the Midlands, but provided with excellent facilities for transport by railway and canal; the Electricity Department maintains a progressive policy, and there is every prospect of a successful future before both the town and its electrical undertaking.

In conclusion, we tender our thanks to the borough electrical engineer, Mr. S. T. Allen, for the facilities which he kindly afforded us for the preparation of this article, and to his staff for their courteous assistance.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Summer Meeting at Western Centre.

The first post-war summer meeting of the Institution of Electrical Engineers that was recently held at the Western Centre was pronounced by one and all who took part in it to be an unqualified success. Its popularity was undoubtedly largely due to the wise decision to avoid in the arrangements anything in the nature of formal meetings, and thereby afford an opportunity of devoting the whole time to the development of the purely social aspects of the meeting.

We are enabled this week, by the courtesy of Mr. C. H. Wordingham, who, as usual, was noticed to be particularly busy with his camera, to reproduce a selection of snapshots taken in South Wales and Monmouthshire during the visit.

Everything favoured the event; on the whole the weather was good, and the fresh breeze on the charabanc drives and steamer trip was worth much to those city dwellers who took part. Pessimists there were who foresaw no happy issue, but well-thought-out organisation carried the project through almost without a hitch. Some there were who found fault with the smallness of the number of participants, but a large party is apt to become unwieldy.

With a group of moderate dimensions there is more sociability and comfort, and opportunity is afforded for all its members to become acquainted; friendships formed in such circumstances are of the best and most lasting.

Functions of this kind play an important part in the life of young engineers, and, indeed, in the life of all engineers. They provide an opening for the younger men to come into contact on a plane of social equality with their seniors, which is not possible in their everyday course of work. Moreover, they enable informal exchange of opinion on current topics of the day to be made in a way that should be of the greatest possible benefit to all concerned.

In conclusion, it only remains once more to congratulate all those who were concerned in planning and carrying out the arrangements. Much time and unobtrusive hard work was spent in ensuring the success of the outing, the reward for which was the complete success with which the efforts of those responsible were crowned.

HIGH-VOLTAGE D.C. RAILWAYS.

The unqualified success that has attended the operation of high-voltage D.C. railways in the U.S.A. is attracting much attention all the world over. The success of the higher D.C. trolley voltages is due to a large extent to its logical development from existing well-tried 600-volt equipment. The first 1,200-volt car equipment used two 600-volt motors in series, followed later by straight 1,200-volt motors. From this point it was only a short step to 1,200/2,400 and 1,500/3,000-volt motors for steam road electrification. Even less difficulty was encountered in building sub-station equipment for the higher pressures. Synchronous converters are operating at 1,500 volts on 25 cycles with the same success as 600-volt machines, while 2,400- and 3,000-volt motor generators are giving unquestioned reliability under severe service conditions. A revised table in the *General Electric Review* contains interesting information on additional equipment and new D.C. railroads. Notable additions include the Othello-Seattle Tacoma division of the Chicago, Milwaukee, and St. Paul R.R., with 217 miles which has been electrified on the 3,000-volt D.C. system; the Hershey Cuban Railway in Cuba, at 1,200 volts; and the Salt Lake, Garfield & Western Railway, at 1,500 volts. The number of high-voltage D.C. lines in the U.S.A. and Canada totals 45, of which 32 operate at 1,200 volts; 9 at 1,500 volts; two at 2,400 volts; and two at 3,000 volts. In 20 cases catenary overhead suspension is used; in six catenary trolley; in nine direct suspension; in three catenary double trolley; in two direct suspension and double trolley; and one each of the following: Catenary and direct suspension; third rail over-running direct suspension; third rail over-running catenary; third rail and catenary; and one eleven-point catenary trolley. The transmission line pressures vary from 2,000 to 100,000 volts; in 23 cases 3-phase, 60 cycle energy is transmitted; in 12 cases 3-phase, 25 cycles; in two 3-phase, 30 cycles; in one 3-phase, 50 cycles; in one 2-phase, 60 cycles; and four systems have no transmission lines. In five cases high-pressure D.C. has superseded high-pressure single-phase; in nine D.C. 600-volt; in 11 steam; and 20 of the lines are new. In addition to the above there are five other D.C. high-pressure railways, one each in Chile, Cuba, Japan, China, and Australia. In each of the latter cases steam operation has been superseded and catenary overhead equipment is used. Three systems operate at 1,200 volts; one at 1,500, and one at 2,400 volts. The transmission pressure varies from 2,300 to 33,000 volts, being in three cases 3-phase, 60 cycles, and in the other two 3-phase, 25 cycles. Finally, a recent report on South African railway electrification was in favour of the D.C. high-pressure system, and the French Commission on railway electrification in France "does not hesitate to formally conclude in favour of the adoption of this system," it being considered to be "the only system suitable for the electrification of heavy traffic lines."

White Gowans.

A Popular Figure.

Masters and Men.

The Transporter.

At Caswell Bay.

A Genial Guide.

The End of a Perfect Day.

The I.E.E. in South Wales.

SIMPLIFIED SUB-STATIONS.

In our report of the recent I.M.E.A. Convention, in the discussion on Mr. Gillin's paper, we mentioned that Mr. F. W. Purse, M.I.E.E., engineer and manager of the West Ham Electricity Department, gave particulars of sub-stations of rather daring design which, he found, had been in use at West Ham for twelve years, and had given every satisfaction. Mr. Purse has kindly furnished us with drawings of some of these sub-stations, which are reproduced herewith. As he stated at Bradford, no brickwork was used round the transformers, which had been housed under corrugated iron or concrete roofs in the open air; the switchgear only was enclosed in a chamber. The transformers could be rolled out clear of the shelters for inspection.

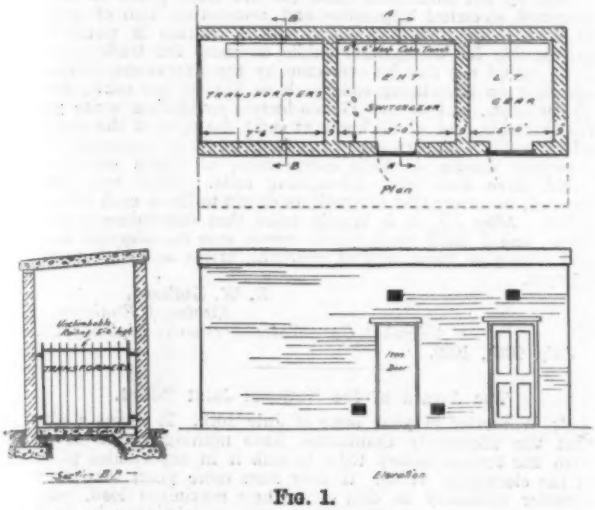


FIG. 1.

At West Ham it had been found the best practice to put the E.H.T. switchgear on one wall of the sub-station, without stone and iron frame cubicles. Isolating switches, current transformers, and oil switches, are kept in stock, and at comparatively short notice can be installed in large or small sub-stations to meet any likely immediate requirements; the whole gear is protected by a glass screen with sliding panels. In carrying out this work the cost of a few spare isolating switches is negligible, and the space occupied for the same number of ways is less than with the cubicles. The standard height of a switch-chamber at West Ham is 10 ft., and for a transformer chamber the same as the switch-chamber, for uniformity, or, say, 2 ft. above the transformers.

The accompanying illustrations show sub-stations for different capacities which are actually in use on consumers' works. That shown in fig. 1 was erected last year (1919) at a cost of £150, and includes a chamber for low-tension gear in which the consumers' meters, main switch, &c., are installed. Transformer capacity of 200 KW. could be easily installed in the existing transformer chamber, and in the event of extra transformers being required a similar transformer chamber could be erected at the other end of the existing sub-station.

Fig. 2 shows a sub-station suitable for four 250-K.V.A. transformers; the E.H.T. switchgear chamber and the consumers' switch chamber, to save floor space, are placed together over the transformer chamber. Duplicate E.H.T. service cables are brought into the E.H.T. chamber, one of which only is switched in at one time. The transformers are connected through oil switches, &c., to the bus-bars. The L.T. switch-chamber is used by the consumer as a distribution chamber, several large-sized underground cables being brought into it by consumers to L.T. feeder-switches. The meters are also installed in this chamber. The question of increasing the capacity of the chamber 50 per cent. has already been under consideration.

Fig. 3 shows an E.H.T. switch-chamber and transformer-chamber for supplying two rotary converters of 300-K.V.A. each installed in the engine room, against which the sub-station is placed as a lean-to. Here the metering is done on the E.H.T. side of the transformers, these transformers being placed in the E.H.T. switch-chamber which is installed in the engine room adjoining. Two oil switches are installed in the switch-chamber (one for each pair of transformers), the operating handles of these switches being on the consumer's side of the chamber, inside the engine room.

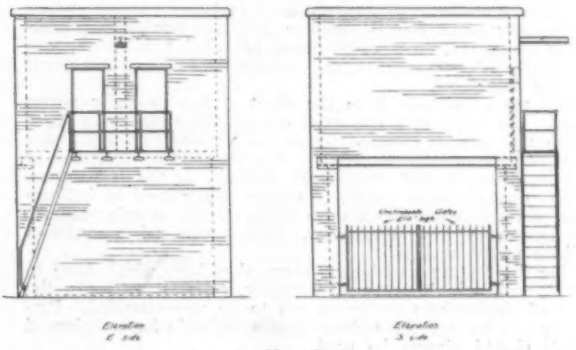


FIG. 2.

Fig. 4 shows a section of the general arrangement of E.H.T. switchgear. After fixing, all bare copper is taped with "Empire" tape. The arrangement shown is comparatively cheap, safe, and easily inspected. Inconvenience has been experienced in some cases by the cracking of isolating-switch insulators, and several reasons have been suggested as the cause. These porcelain insulators have now been superseded by "Siluminite" ones, which have so far proved quite satisfactory.

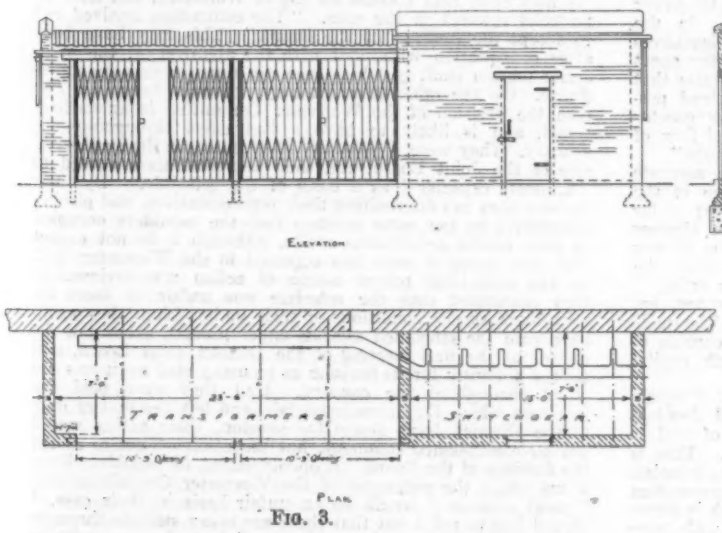


FIG. 3.

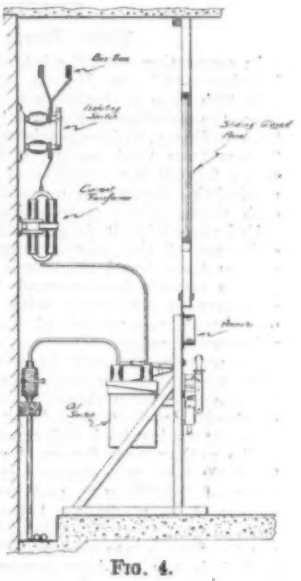


FIG. 4.

Electrical Illuminations.—On the occasion of an open-air fancy dress ball in aid of the St. Dunstan's Blinded Soldiers and Sailors, on Friday, July 16th, the whole of the decoration and electric lighting work, including the coloured lamp illumination of the band stand and grounds at the Old Bull and Bush Hotel, at Hampstead Heath, was carried out by the GRAY ELECTRIC CO., of Denmark Street, W.C. 2.

E.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Single-phase Meters on Balanced Three-phase, Three-wire Systems.

The article which appeared under the above heading on page 741 in your issue of June 11th is misleading.

Single-phase meters, when used to indicate the power on balanced three-phase, three-wire systems, are not connected up in the manner indicated by the author. To do so would be hopeless, as the readings would be entirely fallacious.

There are several methods, however, whereby the difficulty mentioned by the author, due to varying power factor, can be obviated.

For example, if the three-phases be designated A, B, C, then the current coil of the wattmeter can be connected in phase A with the potential coil connected from phase A to neutral point. Alternatively with the current coil connected in phase A the potential coil can be connected from phase A to a point midway between phases B and C.

Another method is to use two potential transformers suitably connected, or a single-phase potential transformer can be used with two current transformers for feeding the current coil of the meter.

All these methods have the effect that with unity power factor the current in the series coil of the meter is in phase with the voltage supplied across the terminals of the shunt coil of the meter. It follows, therefore, that variations of power factor do not impair the accuracy of the indications. Such a single-phase meter, of course, when used to indicate the power or energy of a three-phase circuit, is only accurate as long as the load is balanced. This, however, is a condition which rarely obtains.

For integrating watt-hour meters, therefore, which have to work with a high degree of accuracy, even at low loads, the use of single-phase meters is not to be recommended. Properly constructed three-phase meters, suitable for unbalanced load, should always be used.

For integrating watt-hour meters, therefore, which have to to show the power being absorbed at the moment, a single-phase instrument, owing to its simplicity of connections, is often to be preferred. For indicating the power consumed by a large motor, for example, there is no objection to a single-phase instrument being used.

Charles C. Garrard.

Witton, Birmingham.
July 12th, 1920.

Water Power Development.

In connection with the interesting article on "Water-power Development," by Mr. L. E. Wood, A.M.I.E.E., in the July 16th issue of the REVIEW, the author appears to lay stress upon the development of tidal powers in this country apart from ordinary hydro-electric schemes. Mr. Wood states that "apart from tidal energy, it is estimated that England possesses 900,000 H.P. capable of development, but far greater possibilities depend on our ability to utilise the tidal flow of such rivers as we possess that meet the requirements."

Unfortunately, it is extremely difficult to obtain accurate estimates of the cost of any hydro-electric scheme at the present time, but I think it is generally admitted that as far as this country is concerned, the prohibitive capital charges necessary in connection with a tidal energy scheme of any magnitude, rule it out of the question for near future developments, unless, of course, natural storage basins exist.

As regards ordinary hydro-electric schemes, however, engineers are generally in agreement that a start should be made at once to develop those schemes which will prove capable of *economic development*, despite the somewhat high capital expenditure involved under present-day conditions.

The author gives figures showing a saving of coal of nearly 9,000,000 tons per annum, based on the estimated development of 900,000 H.P., and assuming that 2.5 lb. of coal is consumed in producing 1 H.P.-hour of electricity. This is certainly a modest estimate of the fuel to be saved, as translating the figures into electrical energy units, a coal consumption of 3.35 lb. per KW.-hour generated is obtained, which is somewhat better than the average in this country, with poor grades of coal. Assuming coal of a calorific value of 11,000 B.TH.U. per lb., and 3.35 lb. per KW.-hour generated, we get a thermal economy figure of 36.85 B.TH.U. per watt-hour generated, or an overall efficiency of 9.25 per cent., which is above the average for Great Britain.

The statement that "water power is many times more efficient than power produced from coal; at least 90 per cent. efficiency is obtained from the amount of water passing through the turbine, against 20 per cent. from coal," seems to require further details to support it. The mechanical efficiency of a turbine may reach 90 per cent. or over under favourable conditions, but a steam turbine will also show 90 per cent. or more as regards mechanical efficiency. Even assuming 90 per cent. turbine efficiency and 94 per cent. generator efficiency, the overall efficiency of hydro-generation would be 84.6 per cent., somewhat above that to be obtained under even favourable conditions of operation. A 20 per cent. efficiency from coal generation is considered a creditable figure to-day, and requires up-to-date plant, a high load factor, and skilful supervision to attain it, and it is safe to say that a thermal economy figure of approximately 17 B.TH.U. per KW.-hour generated, is an ideal to aim at in large stations with the present-day classes of coal.

Mr. Wood's article draws attention to a most important subject as the production of cheap power will largely depend upon the efforts of electrical power engineers.

L. Marshall Jockel.

Glasgow.
July 18th, 1920.

A Trade-Price Code.

Why do not advertisers state the net trade prices of small standard electrical apparatus and accessories, also of goods in your "For Sale" columns? Is it because it would be undesirable for the general public to know the trade price? If so, could not this be overcome by the ELECTRICAL REVIEW adopting an advertising code such as XO=10 per cent., Y5=25 per cent., and so on? Trade buyers could then write you for this code, and would know at sight the price of the article advertised. Some firms may not desire their prices to become generally known by their competitors, in which case they could have their own advertising code. They may rest assured, however, that competitors do get to know each other's prices. After all, it is largely price that determines a purchase, and I think such a code would save considerable time and money in these days of changing prices and high postal charges.

B. W. Gothard,
Electrical Engineer.
Aldershot Gas, Water & District Lighting Co.
July 20th, 1920.

The Award of the National Joint Board.

Re Worcester in your issue of July 16th. It seems a pity that the Electricity Committee have nothing better to do with the town's money than to sink it in superfluous plant at the electricity works. If they have more plant than they consider necessary to deal with their maximum load, why not raise money on some of it? They might then be in a position to pay their officials the just and proper staff awards.

True Economy.

July 20th, 1920.

With reference to your editorial remarks *re* Joint Boards in your issue of July 16th, and the statement under "Lighting and Power Notes," regarding Worcester, I should deem it a favour if you will allow me a few lines to state the case from the point of view of a staff engineer.

I may state that I know no one at Worcester, and have no personal interest in the case. "The committee resolved not to accept the findings of the Board." This may have been after consultation with, and with the approval of, the Worcester station staff, in which case my remarks may be superfluous. On the other hand, it may not have been. In any case the decision of the Worcester Committee is unconstitutional, and is likely to have a bad effect throughout the country. They were, I presume, represented on the employers' side of the Joint Board, and their representatives agreed to "kilowatt capacity" as a basis of the schedule. By their decision they are discrediting their representatives, and placing themselves in the same position that the moulders occupied in their recent unfortunate strike, although I do not expect that this point of view has occurred to the Worcester T.C. In any case their proper course of action was obvious. If they considered that the schedule was unfair to them on account of special conditions in their undertaking, they could have paid the scheduled salaries under protest, submitted the matter to the first meeting of the District Joint Board, and waited patiently for its decision as so many staff engineers are doing throughout the country. Had they even paid the increases which they considered fair, and left the matter over to the District Joint Board for revision, their action would not have occasioned comment, but the resolve "not to accept the findings of the Board" is openly asking for trouble. Even if we admit the argument of the Worcester Committee that "plant capacity" would be an unfair basis in their case, I should like to point out that there are many stations throughout the country operating with insufficient plant capacity in relation to their maximum load, and taking the argument as sound, it would be up to the staff engineers in all these stations to ask for salaries in excess of the schedule, on the ground that their plant capacity was insufficient to provide adequate stand-by for their maximum load. Doubtless the Joint Board considered the relative merits of "maximum load" and "plant capacity" as a basis for the schedule, and having arrived at a decision, it is the duty of all concerned to honour that decision. In any community citizens who fail to carry out laws framed by their representatives have to be brought to their senses by the legal authorities of the community.

The Worcester Committee doubtless congratulate themselves on having saved their borough a few pounds per annum, and no doubt consider that they have given a lesson to an upstart association. Nothing could be further from the facts of the

case. Their resolve will have a more disastrous and far-reaching effect. It is such resolves that force protective associations to local and unconstitutional action, and drive them back to the old policy of "get what you can" instead of "get what is right."

The Electrical Power Engineers' Association has in a few years grown to be an association of considerable influence, and is beginning to be felt as a power in the land. It has always been noted for its ability to look at a dispute from both sides, and for its constitutional methods. It believes in the principle of joint conferences. It is quite ready and eager to submit all disputes to the District Joint Boards, and to accept their decisions. If the employers' side can foster a similar spirit all will yet go well. The Worcester resolve has struck a blow at the very foundations of the Whitley Council edifice, which has been the work of strenuous and fair-minded men for years past, and if other Councils are going to follow its example they may eventually bring down the whole structure, but let me remind them that mighty structures make a mighty crash in their fall, and among the ruins strange things may happen. On that day, if we are unfortunate enough to see it, I trust the Worcester Committee will remember that they once pulled a stone out of the foundations.

Justitia Fiat.

July 19th, 1920.

The Imperial Wireless Chain.

I have read the article in your issue of the 16th inst. upon the "Imperial Wireless Chain," in which you say that "without discussing the merits of the rival schemes, we must express the opinion that the decision of the Marconi Co., owing to a personal quarrel between the managing director and the chairman of the Committee, to abstain from giving evidence before the Committee was a strategical blunder of the first magnitude."

You will, I am sure, consider it fair to me to make this correction. There is not, and never has been, any personal quarrel between the chairman of the Committee and myself, nor have I ever had, so far as I can remember, a personal quarrel with anybody. The matters with which I have had to deal, and in which I have figured, have been on behalf of and in the interests of my company as managing director, and in no case have they been personal.

With regard to the question of the blunder of the Marconi Co. refusing to give evidence before the Committee so long as the then chairman presided over it, have you not lost sight of the fact that the company had indisputable evidence that Sir Henry Norman had been in the habit of communicating with a German competitor of this company, and promising to give him information with respect to the Marconi Co., and its technical knowledge, which would have been of great value to that German competitor?

In such circumstances, independently of other reasons, is it to be conceived that the Marconi Co. could appear before this same person as chairman of the Committee, and give to him very confidential information of a nature which would be of great assistance to a German or other competitor, and to the prejudice of the Marconi Co.?

Marconi's Wireless Telegraph Co., Ltd.,

GODFREY C. ISAACS,
Managing Director.

London, W.C.
July 21st, 1920.

"We Must Export to Live."

It is well that in your issue of July 16th you draw attention to what you call the "export vision." There can be no two opinions about the vital importance of insisting on the merits of British goods, and now, whilst the home markets are busy, is the time for propaganda work.

Our own company is fully alive to its importance. Our Mr. E. P. Bennett, whose informative articles in the ELECTRICAL REVIEW on continental opportunities have been of great value to the trade, has just returned from another of his tours, this time in the Scandinavian countries, and is now starting again for southern Europe. There have also been extended journeys in France, Belgium, and Holland. These are propaganda journeys; the immediate business results are not part of our calculations, gratifying though these may be. On his return Mr. Bennett will be pleased to give any information to manufacturers interested, either on general conditions or business possibilities.

Our reason for writing is to encourage others, and to add a little weight to your appeal to British manufacturers to spend all they can on building up an export goodwill for British electrical goods. It was by this "export vision" that our country built up what success it had in the past, and it is by this same that our country's future will be made secure.

The live trader owes a debt of gratitude to the REVIEW for so constantly "rubbing in" this vital truth.

R. W. Hayman,

Manager Export Department, Simplex Conduits, Ltd.

Birmingham, *July 22nd*, 1920.

[Several letters are unavoidably held over to our next issue. —EDS. ELEC. REV.]

LEGAL.

STEALING ELECTRICITY BY SAFETY PIN.

FREDERICK RODERICK, a Barrow shipyard clerk, was fined 20s. and ordered to pay £1 8s. for advocate's fee, by Barrow magistrates on Friday last, for stealing electricity. Mr. Hanning, solicitor, prosecuted on behalf of the Isle of Walney Estates Company, which owns the bulk of the houses at Vickerstown, Walney Island, and he explained that the defendant was a tenant of one of the company's houses in King Alfred Street. The company paid the Barrow Corporation for the electricity supplied to the houses at Vickerstown, and then sold it again to the tenants, who were supplied by prepayment meter. On Mr. Kay and a Barrow Corporation meter inspector visiting the defendant's house on July 1st they found an ordinary safety pi nconnecting the wires just above the meter, with the result that current was being used without having passed through the meter. The defendant wrote a letter to the Barrow borough electrical engineer saying that he did not know that the current was not passing through the meter. Mr. David Kay, manager to the Estates Company, said that in this particular street there had been a loss of electricity to the value of £13 10s. for 14 houses over a period of six months. William Allington, meter inspector, said that in December last he found a pin on the wires, and he told the defendant's wife it was not playing the game. Defendant denied any intention of stealing current. He said on June 30th he had no change for the meter, and a man told him to connect the wires with a pin. He did this quite openly, and on the following morning the officials found it.

LEATHERHEAD ELECTRICITY CO. FINED.

AT the Epsom Petty Sessions, the Leatherhead & District Electricity Co., Ltd., was fined £5 and two guineas costs for suffering offensive fluid matter to pass into the River Mole.

TELEPHONE RATES.

THE Report of the Departmental Committee on Telephone Rates, issued recently (Cmd. 804, price 9d. net), commences with a brief history of British tariffs, and shows that prior to the war the telephone service, as a whole, showed a fair margin of profit; in 1912-13 there was a profit (after providing for depreciation and interest on capital) of £303,348; in 1913-14 there was a profit of £239,111, but in 1914-15 a loss of £111,018. The estimated loss for 1919-20 was £1,950,000. Administration and operating expenses have risen by about £3,200,000, engineering salaries and wages by about £2,500,000, the total for 1920-21 being estimated at £8,175,000, under these heads, compared with £2,472,091 in 1913-14. Including all items, the expenditure in 1920-21 is estimated, at £13,700,000 (£5,952,073 in 1913-14), and the revenue at £9,720,000 (£6,191,184 in 1913-14), leaving a deficit of £3,980,000 next year.

The allowance for depreciation in 1920-21 will be £2,310,000, compared with £1,471,320 in 1913-14, and the contribution from revenue in respect of pension liability will be £740,000, against £400,000. The gradual introduction into the system of an increasing proportion of plant purchased at present prices, three times the pre-war cost, will tend to swell the deficit.

Experience shows that there is no net reduction in costs as development proceeds. Economies due to the increasing density of service are neutralised by the increased complexity and cost of the exchange plant and of the operating arrangements required to give a large number of subscribers intercommunication. The equipment of a small exchange is relatively cheap, but the cost per line for "multiple" exchanges is nearly twice as much in a single-exchange area, and where several exchanges with junction lines are required the cost per line of the exchange equipment varies as follows:—

Subscribers ...	200	1,000	5,000	10,000
Cost per line	£8	13'2	14'6	17

At the same time, an operator who can deal with 147 lines in a single exchange can only cope with 72 in a large multi-exchange area. The advantage gained by the individual subscriber from the development of the system lies, not in a reduction of his subscription, but in the increased number of persons he can communicate with.

Hitherto telephone tariffs have favoured the large user at the expense of the small user. The cost of operating a given number of calls on a busy line is usually greater than that of operating the same number of calls distributed amongst a group of small users, owing to the number of "engaged" calls. Increased traffic means increased costs both for plant and operators, but on the flat or "unlimited service" rate it brings no additional revenue, while the flat rate is a direct inducement to the subscriber to overload his line; some one-line subscribers are making calls at the rate of over 10,000 a year, whereas the maximum capacity of a line, if its efficiency for inward as well as outward calls is to be unimpaired, is not more than 5,000 each way.

The Committee recommends that the flat rate be entirely abolished (there are at present about 31,000 lines in London, and 90,000 in the Provinces rented at "unlimited service" rates); that

the "measured service" rates, which also favour the large user, should likewise be abolished, and that the "message" rate (a fixed annual charge and a uniform charge per effective local call), which places the large and small user on precisely the same footing, be adopted as the general tariff. A preferential rate to residential subscribers is not warranted by the cost of supplying the service, but the minimum charge for calls, whether made or not, should be discontinued.

A careful study has been made of the detailed elements of plant, operating, accounting, and administrative costs. The excess of present over pre-war costs for the plant of a local system is 204 per cent., of a trunk system 114 per cent. over all. The annual charges on the plant have risen by, for interest, 374 per cent. (local), 209 per cent. (trunk); for depreciation, 204 per cent. (local), 114 per cent. (trunk), and for maintenance 124 per cent. in both cases.

Assuming that prices will remain constant for, say, five years (though it is hoped that by that time they will be much lower), it is estimated that for the years 1920 to 1924 inclusive, the total expenditure on renewals and new plant will be £28,160,000 (local), £7,455,200 (trunk). These figures have been compounded with the cost and volume of pre-war plant expected to remain in use to the end of the period, for the assessment of the annual charges. The results are as follows:—

	London.	Provinces.
Annual cost per line	£7·5	£8·23
Total cost per message	1·65d.	1·38d.

The adoption of a uniform message fee enables a marked economy to be effected in recording calls by the adoption of electrical registration, a point of increasing importance, especially in view of the development of the automatic exchange system. The Committee, therefore, recommends a uniform message fee of 1½d., the provincial subscriber receiving a compensating reduction in his annual rental, namely:—London, £8 10s.; Birmingham, Glasgow, Liverpool, Manchester, £8; elsewhere, £7 10s. For trunk calls a sliding scale in multiples of 1½d. is proposed, according to distance, tending towards a final value of 1s. per 50 miles.

It is recommended that in future the London area shall comprise exchanges within a circle of 10 miles radius from Oxford Circus; as a result, Provincial rates become applicable to over 6,000 subscribers at present paying London rates.

Numerous anomalies exist in the trunk system, and it is proposed in future to adopt a uniform mileage scale, a special system of charging, however, being devised for the London area, and the other cities above-named. The separate trunk accounts will be discontinued.

In order to diminish the number of "engaged" calls, due to the overloading of lines, which at present cost more than £1,000,000 per annum, the Committee recommends that the P.M.G. should take power to refuse service to any subscriber who declines to rent a sufficient number of circuits to receive at least four-fifths of his incoming calls without delay. Additional lines are offered at a rental £1 less than the first.

A uniform charge for extra mileage beyond the present specified distances is recommended.

With regard to party lines, these offer no advantage for short distances, but above one mile radius a two-party line will be offered. Farmers' lines will be continued, up to 12 subscribers per line at £4 each, for unlimited local service. Extension instruments, private branch exchanges, private wires, public call offices, and various other matters are also dealt with in the report. Quarterly settlement of accounts is recommended, though it involves a loss of revenue of £3,500,000 in the transition year, less £900,000 for additional deposits, the rental being paid in advance and the message fees in arrear.

If the new tariff is introduced towards the end of 1920-21, it is estimated that in the three following years profit balances of £800,000, £600,000, and £200,000 respectively will accrue; in 1924-25 there will be a loss of £500,000, due to the increasing proportion of post-war plant in use, to meet which it is proposed to make a percentage addition to the subscribers' accounts, sufficient to keep the service on a remunerative basis.

Appendices give numerous statistics and data relating to the British and foreign telephone services.

BUSINESS NOTES.

Bankruptcy Proceedings.—THOMAS, B.E., electrical engineer, 12, Castle Meadow, Norwich.—Receiving order made July 19th, on creditor's petition. First meeting, July 31st; public examination, September 13th; both at Norwich.

JAGGER, JOHNSON, electrical engineer and contractor (as J. Jagger & Co.), 28, Northgate, Halifax.—Adjudication order, July 21st. First meeting, August 5th; public examination, September 24th; both at Halifax.

A. R. MEGGETT, electrical engineer, 45, Thrumpton Lane, East Retford, Notts.—Receiving order, July 23rd, on debtor's own petition.

Company Liquidations.—INSULATION AND METAL FITMENTS, LTD.—Meeting of creditors, August 3rd. All have been, or will be, paid in full.

PEARSON'S ELECTRIC MINERS LAMP CO., LTD.—Winding up voluntarily. Liquidator, Mr. A. E. Green, 100-104, Moorgate Station Chambers, E.C. 2.

Dissolutions of Partnership.—PARKES & O'SULLIVAN, electric welders and motor repairing works, &c., Union Street, Newport.—Messrs. W. G. Parkes and J. O'Sullivan, have dissolved partnership. Mr. Parkes attends to debts.

ARMATURE REPAIR CO., makers and repairers of motors and dynamos, Llanrwst Street, Liverpool.—Messrs. J. Copland and W. A. McGuire have dissolved partnership. Debts will be attended to by Mr. Copland, who will continue the business.

Trade Announcements.—MESSRS. THAIN & THOMSON, who have recently resigned their positions with Sir W. G. Armstrong, Whitworth & Co., Ltd., Elswick, Newcastle-upon-Tyne, have started in partnership as consulting electrical and mechanical engineers at Commercial Buildings, 7, Side, Newcastle-upon-Tyne, and wish to receive latest catalogues, price lists, &c. Tel. "Central 2797," Newcastle-upon-Tyne.

MR. W. KEMP, previously employed in the electrical department of the National Shipyards, and on the electrical staff of Thomas's Soap Works, Bristol, has commenced business as an electrical contractor at 7, Robertson Road, Eastville, Bristol. He wishes to receive manufacturers' catalogues of lighting, heating, and cooking appliances.

MR. C. B. THOMPSON, export engineer, has opened up business at 52, Shaftesbury Avenue, London, W. 1, with a view to exporting machinery and plant to the Far East. He invites correspondence from manufacturers with regard to agencies.

MESSRS. TOFIELD & ROBINSON, LTD., of Birmingham, are opening showrooms and stores, in conjunction with contracting business, at 17, Wells Street, Oxford Street, London, W. 1, with Mr. F. W. Twentyman as manager. The trade are asked to forward catalogues there. Telephone, "Museum 7892; telegrams, "Electrocar, Phone, London."

Catalogues and Lists.—MR. W. M. HARRIS-BURLAND, 63, Queen Victoria Street, E.C. 4, sends us the following catalogues of firms for which he is the London representative:—The PARSONS MOTOR CO., LTD., Southampton.—A collection of illustrations and designs showing the incorporation of "Parsons" engines in various descriptions of stationary and portable plants (34 pp.). ASHWORTH AND PARKER, Bury (Lancs.).—An illustrated description of various types of "Parker" engines for use in a large variety of situations (46 pp.). Mr. Harris-Burland also represents, among other firms, R. A. Evans, Ltd., of Leicester, electric lift engineers.

MESSRS. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—Two illustrated booklets, comprising notes for salesmen and an account of how the manufacturers are helping to sell the new "Plexsim" electric iron.

THE ELECTRIC LAMP MANUFACTURERS' ASSOCIATION OF GREAT BRITAIN, LTD., 46, Queen Victoria Street, E.C. 4.—Booklet (12 pp.) entitled "My Electric Home," an illustrated description of an electrically-equipped dwelling.

THE ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., Bank Buildings, 109-111, New Oxford Street, W.C. 1.—Booklet (16 pp.) and folder dealing with the "Matthews" fully automatic lighting plant.

GEORGE ELLISON, Perry Bar, Birmingham.—Catalogue No. 304 (16 pp.). An illustrated and priced descriptive list of totally-enclosed, self-resetting emergency and shunt-limit switches for cranes, lifts, &c.

GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, E.C. 4.—Installation Leaflet No. 2,316, illustrating and describing the electrification of a large aeroplane works.

THE SUN ELECTRICAL CO., LTD., 57-59, Neal Street, Long Acre, W.C. 2.—An attractively-illustrated catalogue (32 pp.) of "Sunco" electric signs of many types for all purposes.

MESSRS. JOHNSON & PORDES, 8, Crawford Passage, Farringdon Road, E.C. 1.—Leaflet dealing with the "Elba" dry cell.

INTERNATIONAL TIME RECORDING CO., LTD., 57, City Road, Finsbury, E.C. 1.—Booklet illustrated in colour and dealing with automatic time and costs recorders.

BRITISH INSULATED AND HELSBY CABLES, LTD., Prescot, Lancashire.—General illustrated catalogue printed in French.

WATSON & SONS, LTD., Parker Street, Kingsway, W.C. 2.—"Sunic Record," No. 11, June, 1920, containing illustrated descriptions of sphere-gap voltmeters, notes on Coolidge tubes, the Sunic exposure meter, a new fluoroscopic screen, and a new apparatus for measuring heart dilatations.

MESSRS. ISAACSON & BROWN, LTD., 39, Furnival Street, London, E.C. 4.—Leaflet, with prices of the "Bettalite" English-made half-watt fitting, with bowl of pure white glass covered with opal.

THE J.L. ELECTRIC CO., 30, Church Street, Birmingham.—Leaflet, illustrating the J.L. Universal Clip for fixing C.T.S. lead-covered and armour-sheathed cables of any size.

Scheme Abandoned.—The Avoca (Co. Wicklow) Electrolytic Copper Co. intimate that they are abandoning their scheme for the present, but hope to continue development work at the mines and take up the electrolytic project later.

Engineering Wages.—On Sunday last, a largely-attended meeting of the Manchester district members of the Amalgamated Engineering Union in Manchester passed a resolution in which it demanded:—"That our Executive Council immediately call into operation a national conference in accordance with the rules of the Amalgamated Engineering Union. We strongly recommend the national conference to adopt the restriction of all overtime throughout the industry, such restriction to be rigidly enforced on all classes of work irrespective of whether it be of a productive nature or breakdowns or repairs to plant or maintenance or repairs generally, except in cases involving loss of life or limb, districts throughout the United Kingdom to be instructed immediately to carry out these recommendations."—*Daily Telegraph.*

It is stated that the Executive of the Union has decided to withdraw from the Industrial Court consequent upon the Court's decision against the claim for a 6d. per hour advance.

According to the *Daily Herald*, under the 1917 agreement wages were to be dealt with by the Interim Court of Arbitration, which was succeeded by the Industrial Court. At a conference which it is said is to be called by the Engineering Shipbuilding Trades' Federation it will be considered whether wages shall continue to be settled as now, by the Industrial Court, or by direct negotiation "backed by the fighting forces of the Unions." Tom Mann, secretary of the A.E.U., has deprecated the taking of local action in some parts of the country to try to get the 6d. an hour which the Court refused. He said that such action, if persisted in, would weaken the Executive in its endeavour to obtain a national advance. He claimed that £6 10s. per week was the lowest minimum which the engineering trades should have. "Their productivity for the good of the community was greater than ever, and fully entitled them to the advance." Certain districts are raising protests and advocating the taking of a ballot on a national down-tools policy if the 6d. demand is not conceded.

Olympic Trial Race at Rugby.—On the afternoon of July 21st, when the Olympic Cross-Country Trial race was run at Rugby for selecting runners to represent Great Britain at the Olympic Races in Antwerp, the British Thomson-Houston Co., Ltd., lent their ground for the purpose. The course was marshalled by the Boy Scouts, and after the race the competitors and officials were entertained to tea by the B.T.H. Co.

Lead.—In their weekly report, dated July 24th, Messrs. James Forster & Co. state:—

> The news from Australia indicates a speedy settlement of the strike a Broken Hill, which has now lasted over 14 months; but, whatever terms are settled, it is highly improbable that the future output of these mines will be anywhere near the pre-war level, and costs must be largely increased. . . . The immediate effect of a settlement may lead to any stocks held there by our Government and by the mineowners being shipped earlier than otherwise.
>
> Imports this month so far are about on a par with those of recent months, and are far below actual consumption. We again emphasise the fact that available imports for home trade for the past eight months only amount to about 40,000 tons, whereas the domestic trade (white, red, sheet, and pipe lead), leaving out the important electrical trades, is consuming at the rate of 100,000 tons per annum, the difference so far being made up out of stock and dismantled war chemical plant, which, of course, are only adventitious helps.

Messrs. G. Cawson & Co. state:—

> The news from Australia seems more reassuring, and from all reports the strike seems at last to be in a fair way of settlement. Should an agreement eventually be arrived at, there is not likely to be any decrease in Australian shipments, as there is still a fair amount of old stock to come forward. The trade demand for all descriptions of manufactured lead seems, if anything, to be worse than ever. Consumers hold aloof from the market. . . . . The outlook for the present is very uncertain, owing to the action of speculators. If they continue their operations, prices may be driven still higher, although consumptive demand would warrant some decline.

Engineering Trade Depression.—The depression in the engineering trade of Lincoln has become much more pronounced of late, upwards of a thousand workpeople being now unemployed in the city. This state of affairs is attributed mainly to the policy of the banks in curtailing traders' overdrafts. Owing to the high cost of labour, material, and power, much more capital is needed to finance a given amount of output than before the war, and as things are the makers cannot finance the production of machinery for which there is no present sale, although they would be quite willing to accept the risks of the markets. The manufacture of general engineering work is also being retarded by the scarcity of castings. —*Ironmonger.*

Annual Outings.—On Saturday, 17th inst., the staff of Mr. Harry Moss, of Bradford, had an outing to Morecambe, where they were entertained to dinner and tea. A toast given by Mr. A. Bairstow, seconded by Mr. C. T. Brown, was responded to by Mr. Moss.

The Athletic Club of Messrs. Geo Kent, Ltd, held their annual sports on the Chaul End Ground, Luton, on Saturday, July 17th. Mr. Walter G. Kent (president of the club) acted as referee, and Mrs. Kent distributed the prizes. There was dancing from 7 to 10 p.m.

Pope's Social and Entertainment Club held their first sports on Saturday, July 17th, at Gunnersbury Park, Acton (by kind permission of Mrs. Leopold de Rothschild). The programme of events included over 400 entries. Mrs. Pope presented the prizes, and in reply to an expression of thanks, said she hoped that the meeting would be an annual one. The St. Pancras Silver Band (Comrades of the Great War) played selections during the afternoon and in the evening for dancing.

The staff and employés of Electrical Installations, Ltd., held their annual outing on Saturday, July 17th. The party, numbering 83, went by charabancs to Brighton. At the luncheon the chairman proposed "Success to the Firm."

The Ediswan Staff Association Concert Party, under the direction of Mr. F. H. Holyday, gave selections from their extensive repertoire at a *fete* and pageant given on Saturday, July 24th, in Bruce Castle Park, Tottenham, in aid of funds for the extension of the Prince of Wales' Hospital. Both the afternoon and evening performances were well supported.

Yorkshire Electric Power Company and the E.P.E.A.—At a meeting of the Executive Council of the Electrical Power Engineers' Association, on July 24th, it was resolved to raise the boycott on the electricity undertaking of the Yorkshire Electric Power Co. No objections, therefore, will be raised to engineers accepting positions with the company. The Council also expressed its satisfaction with the decision of the company to apply the Schedule of Salaries to the members of the technical staff in the service of the company, and also with the active interest shown by the engineer and manager of the company in connection with the National Joint Board.

Annual Holidays.—The works and offices of Messrs. Aland & Co., London, S.E., will be closed from July 30th till August 9th. Correspondence will not be attended to.

The works of The Tok Manufacturing Co., Ltd., will be closed from this, Friday, evening until the morning of Monday, August 9th.

The works and offices of the Benjamin Electric, Ltd., will be closed from to-day, July 30th, until Monday, August 9th for the summer holidays.

The Metropolitan-Vickers Electrical Co., Ltd., of Trafford Park, Manchester, whose works are closed from Friday, July 23rd, till next Tuesday (as already announced in these columns), opened a booking office in the works for the benefit of their employés. That these facilities were much appreciated is proved by the fact that the takings were over £2,000. Arrangements were made for two special trains from the Central Station, Manchester to Liverpool, one from Victoria Station, Manchester to Fleetwood, and one from Victoria to Blackpool. The bookings to Douglas, I.O.M., were 1,050, and to Blackpool 600.

The E.T.U. and the A.E.U.—In the absence of a sufficient number of votes the Electrical Trades Union cannot become affiliated to the Amalgamated Engineering Union. Less than 50 per cent. of the total number of members in the Electrical Trades Union voted, although the majority of those who did vote were in favour of affiliation.—*Manchester Daily Despatch.*

Electrical Supplies in South Africa.—The South African correspondent of the *Ironmonger* reports that prices for electrical goods are on the up grade, as British quotations have risen by from 20 per cent. to 30 per cent. "There is still a shortage of many fittings and accessories such as porcelain and woodware pushes. Wire is plentiful, but about 20 per cent. higher in price than last month. Business, in spite of shortages and enhanced prices, is, however, brisker than of late in Johannesburg, and is expected to continue so in the larger towns, where electric lighting and power are available everywhere. The dark winter nights always give a fillip to the demand for electric lighting, heating, and cooking appliances in such a 'gas-less' country as South Africa. The winter came in with a rush from summer temperature (as understood in Europe) to below freezing-point in the night of June 1st, and such severe cold on the High Veld has not been known in June for many years. As the winter extends into August and September, the season's trade promises well. The present prices of electric wires (covered) are:—3/20, 30s. to 33s.; 3/22, 27s. to 30s.; 7/22, 40s. to 44s.; and 7/20, 55s. to 60s. Very few firms issue price lists, and in most cases quotations are given from day to day. Tubes are fairly plentiful, but are offered at enhanced prices in spite of a lull in building operations due to the new Tenants Protection Bill, which will soon be in force. Lamps are up to 24s. per doz., although in places keeping as low as 20s.; flex costs from 55s. to 75s. per gross yards; and cleats are up to 35s. per 100. Some fittings, such as adapters, have advanced quite 400 per cent. over pre-war prices. The present price of adapters is 21s. per doz., with a possible plus; before the war they were sold at 4s. 6d. per doz."

Brazilian Tax on Foreign Companies.—In a dispatch dated Rio de Janeiro, July 26th, Reuter's Trade Service says that decrees have been issued imposing a tax of 5 per cent. on the dividends and interest paid on holdings in limited companies having their headquarters in other countries. These companies are required to notify in Brazil all calls and dividend announcements published abroad. The 5 per cent. tax will apply to the proportion of the capital that is held in Brazil. Registration of these particulars with the Tribunal of Commerce is compulsory.

Australian Electrical Manufacturing.—With reference to the activities of the English Electric Co., of Australia, recently referred to here Reuter's Trade Service states that the company has purchased 20 acres of land at Clyde, upon which it proposes to erect immediately large engineering works for the manufacture of electrical equipment, turbo-alternators, &c.

Germans in Japanese Employment.—According to a report from Wesel, Germans who have recently returned from Siberia announce that, at the request of about 700 German prisoners of war from Siberia, mostly technical men and trained workmen in the electrical industry, the Chamber of Commerce of Tokio a little time ago recommended the Government to permit these Germans to remain and receive employment in Japan. They are said to have been given employment in railway construction and in the electrical industry, and occupation has also been given to German textile experts who were among the prisoners.

The Felten and Guilleaume Co.—The shareholders in Felten & Guilleaume, Carlswerk, A.G., of Cologne-Mulheim, on July 15th sanctioned the previously-reported proposal to increase the share capital from 60 to 120 millions of marks in connection with the agreement with the Luxemburg Burbach-Eich-Dudelingen Co. and the Terres Rouges Co. Under the agreement the two latter will supply the German company with semi-finished steel for a period of 30 years, and will take over the new shares of 60 millions at the price of 250 per cent., in conjunction with a Luxemburg bank. In return for their renunciation of the right of subscription to the new shares, the shareholders in the F. & G. company are to receive compensation at the rate of 500 marks per share out of the premium realised in the near future, and a further sum of 500 marks per share after the general meeting in 1921 if the working results for 1920 show no decline. The Berlin A.E.G., which recently increased its holding of F. & G. shares "in the interest of the old shareholders" in the latter, has in the meantime concluded an agreement with the Luxemburg group, under which the maintenance of German influence in the F. & G. company will be guaranteed according to the rearrangement of the board of directors under the scheme of capital expansion.

Western Canadian Telephone Requirements.—A large number of particulars with regard to the demand for telephone material and equipment for Western Canada have been collected at the Department of Overseas Trade, and are available for British manufacturers of sets or components. These particulars may be seen by appointment with Captain Vandeleur, Department of Overseas Trade, 35, Old Queen Street, Westminster, S.W. 1.—*Board of Trade Journal.*

Automatic Street Lighting.—Some time ago (May 15th, 1914) we illustrated an electric street lamp devised by Mr. C. J. Turner, electrical engineer to the Hoylake Urban District Council, in which a selenium cell, in conjunction with certain switching apparatus, automatically controlled the switching on and off of the light during periods of night and daylight respectively. We have now had an opportunity of inspecting improved apparatus of a similar character, based on the Turner and Schattner patents, at the offices of MESSRS. ELECTRICAL AND ENGINEERING DEVELOPMENT, LTD., of 82, Victoria Street, London, S.W., which company has taken over the development and exploitation of this system. The apparatus is of an extremely simple and compact nature, and can be relied upon to operate indefinitely without a hitch.

The property of a selenium cell, of changing its resistance to a very considerable extent when exposed to daylight, or alternatively in darkness, is well known, but owing to the very high resistance of such cells and their very low current-carrying capacity, it was necessary to devise, or rather to invent, an automatic switch which would operate with certainty at very low currents, such as $\frac{1}{300}$th of an ampere, and which was of robust and simple construction. Furthermore, it must be capable of making and breaking currents up to 5 amperes on a 250-volt circuit.

The apparatus that we saw fulfils these conditions in a simple and efficient manner, and we hope to describe and illustrate it in detail at an early date. The operation of the switch was perfect and sparkless.

In these days of high-priced labour, central stations will be very glad to have an opportunity of doing away with manual labour in connection with the switching on and off of their street lamps, and Messrs. Electrical and Engineering Development, Ltd., inform us that they are surprised at the interest which has been taken in their new system. They have already been offered the contract for the equipment of several important street-lighting systems, and hope to be in a position to carry out these installations in the autumn.

Incidentally we may note that the firm is engaged in developing several other electrical inventions, and for the purpose of keeping a watch for new ideas, has established an organisation of experts, which embraces not only this country, but also many important centres abroad. By this means it is hoped to "catch them young"; the value to the nation of importing new inventions, and developing them here, in addition to those of native origin, is obvious. Only too often good British inventions have been rejected at home and developed abroad; we hope that in future every effort will be made to secure to this country the benefit of new ideas—for continual progress is essential to the maintenance of our position in the world's trade.

Book Notices.—The July, 1920, "Bulletin," Vol. VII., No. 5, of the Hydro-Electric Power Commission of Ontario, containing illustrated articles on Merchandise Accounting for Hydro Municipalities, Metering the Consumer's Load, the Ranney's Falls Power Development, Hydro Used for Treating Poles, and the Organisation and Work of the Commission's Laboratories.

"The Detroit-Edison Synchroscope." Vol. 7, No. 5, (24 pp.) The July (Midsummer) number of this journal contains articles on "Things not generally known about a power plant," and the Connors Creek installation. Profusely illustrated.

"Introduction à la théorie des Courants téléphoniques et de la radiotélégraphie." By J. B. Pomey. (510 pp., 100 figs.) Paris: Gauthier-Villars et Cie. Price 50 fr. net.

We have received from the Latvian Consulate (4, Drapers Gardens, London, E.C. 2) a copy of the *Latvian Economist*, a monthly publication issued by the Finance Ministry of Latvia and giving information regarding economic life and conditions of the Republic of Latvia.

"*Engineering* Directory." No. 67. May, 1920. London: Engineering, Ltd.

"*Journal* of the American Institute of Electrical Engineers." Vol. XXXIX, No. 7. July, 1920. New York: The Institute. Price $1.

"Vickers News," Vol. 2, No. 20, July 15th, 1920, containing a constructive commentary by Mr. Harry Allcock upon the report of the Royal Commission on Decimal Coinage. Also articles on airship building at Barrow during the war, the firm's exhibits at the Olympia aero show, and the turbine steamer *Manxman*, which was built at Barrow for the Isle of Man service, and recently reconditioned after war service.

Organisation of Industry in Czecho-Slovakia.—The Dutch Minister at Prague, Czecho-Slovakia, reporting on the industrial situation in the Republic, states that a regular improvement, both in the matter of quality and quantity, took place last year in the machinery, metal ware, transport and electrical industries. All the large works and many of those of average size greatly increased their installations during the war, and are now able to produce more than in 1914, notwithstanding the reduction in the working shift to 48 hours weekly. The latter circumstance has brought about an increase in the number of workmen employed, particularly in the large works, where an expansion of from 50 to 100 per cent. is a common occurrence. Worn-out plant has now been replaced by modern machines, and the engineering industry is particularly active. After referring to various departments, the report states that the electrical industry has plenty of orders on hand. The requirements in cables and insulated conductors are met by the inland works, and works for glow lamps, meters and batteries are in course of construction, in order to render the country also in these respects independent of imports. All the industrial groups are formally combined in the Syndicate for the Metal Industry, which has nine departments in which are discussed all questions relating to commercial policy and imports and exports. The council of the syndicate, complemented by representatives of the workmen, consumers and merchants, also acts as an official advisory organisation on behalf of the State Import and Export Commission for the metal industry.

Private Meeting.—A. M. CRAMP, electrical engineer, 12, Regent Street, Haslingden.—The creditors interested herein were called together recently, when a statement of affairs was presented which showed liabilities of £1,224, of which £924 was due to the trade, and £300 to cash creditors. The assets were estimated to realise £562, or a deficiency of £662. The assets consisted of stock-in-trade, £298; fixtures, &c., £100; and book-debts, £164. It was stated that the debtor started trading in 1911 with little or no capital of his own, but he borrowed £200 from a relative, and that amount was still owing. He purchased an existing business, for which he paid £80 cash. The debtor was unable to state what his turnover had been, although books of account had been kept. The bank passbook showed that the turnover during the last year had averaged about £60 a week, but the debtor pointed out that he had had a number of losses on contracts. The position disclosed was discussed at some length, and eventually it was decided that a deed of assignment should be executed with Mr. J. F. Warburton, of Queen Street, Manchester, as trustee, and a committee of inspection was also appointed, consisting of the representatives of Messrs. W. E. Beardsall & Co., Ltd., Mr. Parkin S. Booth, Liverpool, and Mr. Charles Turner, of Sheffield. The following are creditors:—

Glover, W. T. & Co.	£63	W. T. Henley's Telegraph Works Co.	£10
Baxendale & Co.	26	Ward & Goldstone	30
Beardsall, W. E., & Co.	101	General Electric Co.	99
Downes & Davies	111	Credenda Conduits	20
Edison Swan Co.	57	Electrical Supplies	75
Sloan Electrical Co.	59	Palmer, Riley & Co.	56
Vickers & Co.	74	Electric Lamp Factors	41
Falk, Stadelmann & Co.	21		
Parmiter, Hope & Sugden	23		

Disputes.—Among the schemes instituted by the Dundee Corporation to give work to unemployed men was the laying of cables, and the recent award of 4½d. per hour granted to labourers in the building trade has been claimed by the "unemployed," who "downed" tools to enforce their demand. According to Mr. H. Richardson, the Corporation electrical engineer, the men left work without giving the slightest warning, leaving open areas of 50 yards at one part and 200 yards at others. It is suggested that as the work is not in a hurry, the streets should be closed, and the work of laying the cable stopped.

The strike of cable jointers and street box examiners, members of the Electrical Trades Union, and employed by the Liverpool Corporation, has extended to Birkenhead, Bootle, and Wallasey, where these grades of workers have also been withdrawn. The dispute now continues into its tenth week, and has been described as a deliberate attempt to wreck the Whitley scheme in this area, to which the Electrical Trades Union retorts that for these men it is claiming the district rates paid to electricians, with any variations that may follow.

A ballot is being taken of the electricians employed in the Liverpool contracting industry as to whether they will accept the offer of the employers in response to the wages application for an advance from 2s. 1½d. to 2s. 3d. per hour.

The permanent-way men employed by the Newport Electricity Committee are still on strike. About 70 men are involved, but the strikers threaten to call out others. The men are paid 1s. 6d. an hour, and claim the same wages as builders' labourers—about 2s. 1d. an hour. The Corporation reply to the men that their wages are governed by the Industrial Council, and that until the men withdraw from the Council the present wages must continue.

Works Organisation.—In order to obtain some insight into the working and construction of their various manufactures, the head office staff of Messrs. G. Kent, Ltd. (London) visited Luton on July 17th. In the course of a tour of the works, technical details were explained by experts in the different departments. They were also shown the latest improvements in machinery and equipment recently installed.

50,000,000 Insulators Wanted for the States.—H.M. Consul at Boston has sent to the D.O.T. in London samples of three types of porcelain insulators of small size used in the bases of electric bulb fittings, which are required by a firm in Massachusetts. Fifty million of these articles in assorted types, according to the specimens, are required, and early delivery is of importance. The colour is immaterial so long as the type is the same. The samples in question may be seen on application to Captain Vandeleur, D.O.T., Room 49 (Victoria 9,040, Ext. 29).

Catalogues Wanted for Riga.—H.M. Consul at Riga (Mr. E. F. Cable) is establishing at the Consulate a collection of British catalogues for inspection by callers and for distribution among local traders. British manufacturers are asked to send catalogues and samples.

Foreign Purchases of German Siemens Shares.—The Siemens & Halske Co., of Berlin, recently increased the share capital from 63 to 126 millions of marks. At the meeting where a resolution to this effect was adopted the directors mentioned the probability that it would be necessary to place some of the new capital in other countries. It is now announced that large parcels of shares have been disposed of abroad, including the United States. This circumstance does not make any difference in the position or policy of the company, as the control remains in the hands of the holders of the first 9,500 shares—the Siemens family—as mentioned a short time ago.

New Belgian Company.—La Société des Ateliers de Constructions Electriques des Flandres (Joseph & Fils) is the name of a new company which has just been formed in Ghent with a capital of 2,000,000 fr. to carry on an electrical engineering business.

Hendon Aerial Derby.—The engines of the aeroplanes that secured the first and second places in the "Aerial Derby" held at Hendon on Saturday, July 24th, were equipped with B.T.H. magnetos. These were also used on the aeroplanes which secured first and second places in the 1919 Derby, on the R34, and on the aeroplanes which secured some 28 aerial records. These results support the high opinion in which these magnetos are held by pilots for reliability in service.

Auction Sale.—Messrs. P. Huddleston & Co. will sell by auction, on August 10th, at Dalling Road, Hammersmith, W., a quantity of electrical apparatus, including motors, generator, fans, cable and wire, &c. For particulars see our advertisement pages to-day.

LIGHTING AND POWER NOTES.

Aylesbury.—Expert Advice.—The Town Council has appointed Mr. C. H. Wordingham, of London, as consulting engineer in connection with the electricity works, at an inclusive fee of 50 guineas.

Beckenham.—Year's Working.—The financial result of the past year's working of the electricity undertaking was a deficit of £5,279, as against £6,000 in the previous period. This is regarded as satisfactory, inasmuch as a deficit of £8,000 was estimated.

Bexhill.—Wages.—The Council has accepted the Whitley Council's recommendation with regard to the wages of its electrical employés, who will receive an additional 5s. per week. It was stated at the Council meeting that the men were quite satisfied with the 7s. 6d. which was added in March, and made operative as from the beginning of February. It is understood that the rate of wages will shortly be based on the full war advance rate of 39s. 6d., plus 12½ per cent., over pre-war wages.

Proposed Price Increase.—The engineer estimates that these increases, with increased cost of coal, materials, &c., for the current year ending March next will approximate £4,500. To meet this additional expenditure the only course open is to advance charges to the consumer. The Committee is, therefore, applying to the Electricity Commissioners for an order increasing the statutory powers of charge. Application is being made for a maximum charge of 1s. per unit, as against the maximum of 8d. authorised by the Council's Electric Lighting Order of 1897. It is thought that it may be sufficient, so far as future conditions can be foreseen, to charge 10d. a unit for light and 3d. for power.

Loan Sanction.—The Council has received sanction to a loan for the purchase of meters, which have hitherto been paid for out of revenue.

Bingley (Yorkshire).— Breakdown. — The District Council last week held a special meeting to consider what should be done in consequence of a prolonged failure in the supply of electricity to the town by the Keighley Corporation on Tuesday of the same week. A letter had been received from the manager of the Bradford tramway department, whose cars serve Bingley, complaining that the tramway service on the Bingley section had been maintained during the failure only by making use, at considerable inconvenience, of a special supply of electricity from the Shipley electricity works. It was reported that the stoppage of Keighley supply had occurred from 2.47 a.m. on Tuesday, to 5.5 a.m. on Wednesday, the cause being a fault in the transmission line between Keighley and Bingley. The chairman of the Bingley Committee said that in consequence of breakdowns this year, Bingley users had already been without supply during 39 hours 22 minutes. He maintained that the Keighley Electricity Committee had shown not the slightest regard for continuity of supply to Bingley nor for the position in which Bingley had been placed. The chairman of the Council (Mr. J. R. Leach) said he felt that the Keighley Committee must be in ignorance of what had been constantly happening at Bingley. Mr. Pedley, the Bingley electrical engineer, said there were two transmission lines, and when the breakdown occurred, the Keighley department tried to change over to the second line, but it was found that that line also was useless. Several times it had been suggested to Keighley that the duplicate line should be kept always in order and in service, but they had not adopted the suggestion. It was decided, unanimously, to make immediate representations either to the Board of Trade or to the Electricity Commissioners, and that if satisfaction were not obtained, steps be taken, under a clause in the supply agreement, for an independent arbitration between Bingley and Keighley.

Burnley.—Loan Sanction.—Sanction has been received by the Electricity Committee to borrow £95,200 in connection with necessary extensions.

Bolton.—Extensions.—A scheme for extensive additions at the electricity works, involving an expenditure of £500,000, is to be carried out.

Continental.—France.—The report of M. Milan on the scheme authorising the setting-up by the State of a high-tension distribution network in the freed regions comprising three sections—Nord, Ardennes, and Alsace—was presented to the Senatorial Commission on Finance on June 8th. After the reading of the report, the Commission called for the list of charges imposed on concessionnaires before coming to a decision on the vote for the scheme, which totals 135,000,000 fr.

Italy.—In consequence of the electricians' strike, the Province and City of Rome are without light. Army reflectors and acetylene lamps are being used, says *The Times*, for street lighting.

Spain.—A concession has recently been granted for the establishment of plant to utilise the water power of the River Deva, near Deva, for the generation of electrical energy.

Dublin.—Strike.—Owing to strikes of Urban Council employés, Rathmines, Pembroke, and Blackrock townships were last week without electric lighting. Settlements of wages questions have since been made.

Eastbourne.—Year's Working.—The total revenue of the electricity undertaking for the year ended March 31st last was £50,834, as compared with £35,012 for the previous period. Working expenses amounted to £29,101, as against £22,443, leaving a gross profit of £21,733, as against £2,569. The payment of capital charges and the crediting of bank interest resulted in a net profit of £5,756, comparing favourably with last year's deficit of £4,490.

Edinburgh.—Estimated Deficit.—At a meeting of the Electric Lighting Committee, estimates showed that there will be a deficiency next year of probably £7,000. It is expected that a small increase in price will be made for lighting and power from October 1st.

Haslingden.—New Services.—The Town Council has approved the following applications for electricity supplies:—The Scapa Manufacturing Co.; Messrs. J. Cotton & Co.; Messrs. Constantine's & Lindsay's works; and the Wesleyan Chapel, Manchester Road.

Kettering.—Loan Sanctioned.—The Urban District Council has received sanction from the Electricity Commissioners to borrow £39,909 for the purpose of extension of plant, &c.

King's Lynn.—Extensions.—The Corporation is about to incur considerable expenditure in installing an alternating turbo-generator, and laying a submarine cable across the river, with a transforming sub-station on the west bank, for the purpose of supplying electricity to the shipyards at West Lynn.

Leeds.—New Turbo-alternator.—The Council has accepted the tender of the British Thomson-Houston Co. to supply a 12,000-kw. turbo-alternator, with condensing plant and accessories, for £134,450. This is to be installed at the Whitehall Road works as a part of the extension scheme.

Ilford. — EXTENSIONS.— Extensions to the electricity works were officially inaugurated last Saturday. The new plant comprises a Fraser & Chalmers impulse type turbine direct-coupled to a Siemens alternator; the condensing plant was manufactured by Messrs. Worthington-Simpson, Ltd. The output of the set is 2,000 KW. at 3,000 R.P.M. The generated pressure of 2,000 volts is stepped up to 6,600 volts by three Brush transformers. The E.H.T. switchboard (supplied by the General Electric Co., Ltd.) is of the truck type, and consists of five totally-enclosed cubicles controlling the generator, rotary converters, &c. A 60-in. "Sirocco" induced-draught fan and motor has been supplied by Messrs. Davidson & Co., and a new steam feed pump by Messrs. Weir, of Glasgow, has been installed. Mr. A. H. Shaw, M.I.E.E., is the electrical engineer and manager to the District Council.

Liverpool.—MAINS EXTENSIONS.—Further extensions to 27 electrical mains have been approved.

London.— GREENWICH.—Since the L.C.C. last December voted £33,000 for coal-conveying plant at the Greenwich generating station the price has increased to £66,000.—*The Times.*

STEPNEY.—The Council has decided to enter an appeal against the decision of Mr. Justice P. O. Lawrence, in connection with damage and inconvenience caused by smoke from the electricity works (*vide* ELECTRICAL REVIEW, June 18th, p. 778).

The Special Committee on London Electricity Supply of the L.C.C. has in hand a report on a scheme which it hopes to be able to submit to the Council soon after the recess.

Loughborough.—EXTENSIONS.—At a special meeting of the Corporation, held on July 19th, a scheme, prepared by Mr. C. H. Wordingham, was adopted for the extension of the electricity works, involving an estimated expenditure of £149,000, and for new mains costing £35,000. Alderman Bumpus, chairman of the committee, explained that the central feature would be the installation of a 3,000-KW. turbine, and the estimate covered a considerable portion also of the expenditure necessary to the installation of a second turbine, which it was anticipated would be required before the extensions were completed. At the present time their mains were overloaded, and whilst they could not cope with existing requirements, there were further demands in prospect. As to the suggestion that the station might be closed when power was obtained from a joint authority for the area, there was no doubt that the financial conditions of the arrangement would be such that they would not lose by the installation of this additional plant.

Midgeley.—PROVISIONAL ORDER.—The Electrical Supply Co. of West Yorkshire has informed the Urban District Council that it is applying for a provisional order to supply electricity in the district.

Paisley.—YEAR'S WORKING.—The annual report of the undertaking shows that the revenue for the year was £64,254 (as compared with £40,943 last year). The expenditure was £42,699, leaving a gross profit of £21,555. Capital charges amounted to £20,810, leaving a credit balance of £745, as compared with a debit balance of £14,275 in 1918-19. The number of units generated was 7,245,121. Units sold totalled 5,883,975, an increase of 14½ per cent. over the previous year. The maximum demand was 2,950 KW., and 260 new consumers were added, making a total of 2,278 to date.

Price of Electricity.—The charges for electricity are to be increased in the following towns:—Frome, Newmarket (from 8½d. to 1s.), and Bury (by 20 per cent. for lighting and power, and by 10 per cent. for tramway purposes).

Repton.—ELECTRICAL PUMPING.—The Rural District Council is to utilise electric power instead of steam at the Milton waterworks; the electricity will be supplied from the Burton-on-Trent Corporation sewage pumping station.

Rochdale.—WAGES.—The Electricity Committee considers the increases under the award of the National Joint Board, regarding conditions of employment, salaries and holidays for technical members of staffs of electricity undertakings as exorbitant, and its resolution of protest against the scale is being sent to all the undertakings represented on the Lancashire and Cheshire Federation of Authorities.

Steyning (Sussex).—ELECTRIC LIGHTING SCHEME.—A meeting was held on July 20th to consider the formation of a company to supply electricity in the parishes of Steyning, [illegible]mber, &c., and it was resolved to form a company with a capital of £10,000; £3,500 was subscribed at the meeting.

Southampton.—PURCHASE ABANDONED.—The suggested purchase of a local power station and jetty by the Borough Council has been abandoned.

Torquay.—JOINT ELECTRICITY DISTRICT.—A conference of representatives of the Town Council, and the Councils of Paignton, Newton Abbot, and Teignmouth, was held on July 21st, to consider a central scheme for the supply of electricity to the district in bulk. Mr. H. F. Woods, electrical engineer at Torquay, prepared the scheme, and the estimated cost of the station is placed at £230,000. The scheme was approved, and has met with the support of the Commissioners. It is anticipated that energy will be supplied at 2d. per unit.

Thirsk (Yorks.).—CHANGE OF SYSTEM.—The Northern Counties Electricity Supply Co., Ltd., has applied to the Rural District Council for consent to the changing of the system of supply from direct to alternating current, at a periodicity of 40 cycles per second. The company announces that this will not involve an increased price.

Uganda.—ELECTRICITY SUPPLY.—The Crown Agents for the Colonies announce that the Government of the Uganda Protectorate is inviting applications for concessions relating to the development of the Ripon Falls for the production of electricity and also for the supply of electricity to towns in the district.

West Riding of Yorkshire. — JOINT ELECTRICITY AUTHORITIES.—There is disagreement in the area with regard to the composition of the joint electricity authorities proposed under the powers of the Act of last year. Bradford, Huddersfield, and Halifax Electricity Committees have passed resolutions contending that any combination of authorities in the area should be wholly municipal in composition, but Leeds is said to maintain that the Yorkshire Electric Power Co. should be a part of the authority supplying the West Riding. A meeting of many West Riding local authorities recently rejected a Leeds proposal that the joint authority should consist only of Leeds, Bradford, Huddersfield, and Halifax Corporations and the Yorkshire Power Co., though the meeting was not entirely in favour of the idea of the authority being limited to municipalities.

Wrexham.—INQUIRY.—A public inquiry is to be held by the Electricity Commissioners in connection with the Council's proposal to expend £17,260 upon extensions to the electricity undertaking.

TRAMWAY AND RAILWAY NOTES.

Algeria.—RAILWAY ELECTRIFICATION.—*The Times* states that the Governor-General has appointed a Commission to investigate the possibilities of electrifying the existing Algerian railways. The scope of the Commission will also embrace the supply of electricity for industrial and agricultural purposes. The utilisation of the Oued-Agrioum waterfalls for the generation of power for a proposed line from Setif to Bougie, is also contemplated.

Australia.—PROPOSED SUBURBAN RAILWAY.—It has been proposed to construct a branch railway, partly underground, to serve the eastern suburbs of Sydney. It is stated that at present it costs from 10s. to 14s. a ton to carry goods to the outer districts, and a railway is therefore necessary. About 150,000 people are without proper travelling facilities in the districts through which it is proposed to run the line.

DOUBLE WAGES.—It is announced that tramway employés received double pay for work done during the Prince of Wales's visit. This affected 20,000 workers, and the concession involved the sum of £30,000.

Bolton.—WAGES.—The application of the tramway employés for an advance in the basic rate, bringing it up to the rate in the Rochdale district, is to be submitted by the Bolton Tramways Committee to the Whitley Council. The Committee thinks the time has arrived for standardisation of the wages of tramway employés in the area.

Bradford.—TRACK RENEWAL.—The Tramways Committee recommends the City Council to sanction the carrying out of renewals of track at an estimated cost of £54,438.

Continental.—GOTTHARD RAILWAY ELECTRIFICATION.—Dr. Georg Sinner comments in the *Deutsche Allgemeine Zeitung* on the news which arrived from Switzerland that on July 1st, after the Retom power works had commenced the previous night to generate electricity, several goods trains driven by electric locomotives passed through the Gotthard Tunnel without any interruptions. It may, therefore, be said that the electrification of the Gotthard Railway, which presented numerous technical difficulties and has been in hand for a number of years, has been completed. As long ago as 1912, a report of the commission appointed to inquire into the Swiss Federal Railways stated that the introduction of electric traction would reduce the cost of transport by steam-driven trains by between 22 and 25 per cent. After the increase of the price of coal and the growing shortage of coal during the war had made the exploitation of Switzerland's wealth of water power imperatively necessary, it was decided in 1916 to commence the electrification of the Gotthard Railway. The railway is 226 km. in length from Lucerne to Chiasso on the Italian frontier. The actual Gotthard Tunnel is 15·7 km. long and rises from 1,109 m. at Göschenen to 1,154 m. and falls again to 1,145 m. at Airolo; 30 per cent. of the total length of the line is in the tunnel. The Erstfeld-Bellinzona section now electrified is 109·3 km. in length. In the light of experience gained in the Simplon Tunnel and elsewhere it was decided to employ single-phase alternating current. The requisite electrical power is generated in the works on Lake Retom on the south side and at Amstig on the north; the former works, as mentioned above, have just been set going, and the latter are expected to be finished next year. The Retom works in Piotta use the Retom mountain lake as a collecting basin and utilise the fall of the Fossbach from the lake to its mouth in the Ticino. At the present stage of development the works employ four turbines with single-phase generators of 52,000 H.P. in all. When the Amstig works are finished they will provide 78,000 H.P. The single-phase A.C. locomotives of the Gotthard Railway are of three types, a

small engine, a large express train engine and a goods train engine. The heavy express engine weighs 108 tons, and supplies permanently 1,720 H.P., and the goods engine weighs 121 tons, and supplies 1,700 H.P.—*Economic Review.*

Cork.—The Electric Tramway Co. has decided, in view of the enforcement of a military curfew regulation providing that all inhabitants must be indoors by 10 p.m., to discontinue the service shortly after 9 o'clock to allow drivers and conductors to go home in good time.

Edinburgh.—TRAMCAR *v.* BUS.—In a recent report on alternative traffic systems to replace the present cable cars, the manager of the tramways department reviewed the comparative advantages and disadvantages of tramcars and motor-omnibuses, stating that the cost of electrification, including a through service to Leith, would be about £695,700. In his conclusions he states that the electric car would be preferable in districts where a constant traffic is ensured, but infrequent services in other parts could be met more satisfactorily by omnibus.

Electric Vehicles.—The Shildon (Durham) Urban Council is to spend £1,497 on a two-ton electric haulage wagon for use in the scavenging department. The money will be raised by loan.

In the course of a public inquiry held at Wallasey by a Ministry of Health inspector upon application by the Corporation to borrow £2,976 for the purchase of two electric vehicles for the collection of house refuse, it was stated that they would displace six horses and would save 1s. 6d. per ton on loads carried, or £500 per year.

The Minister of Health, not being satisfied that house refuse collection in districts near to the refuse tip can be done more cheaply with mechanical than with horse traction, has decided to sanction a loan for only one instead of two electric vehicles, for which King's Lynn applied for borrowing powers.

Huddersfield.—TRACK EXTENSION.—In connection with the proposed doubling of the lines in Vicarage Road, Longwood, the Tramways Committee has accepted a suggestion of the Minister of Transport that the widening be carried out within the next 12 months. The Committee has deferred the question of doubling portions of the Honley section.

Ilford.—NEW CARS.—Six new tramcars have been released to replace old cars, and 10 more are in course of construction. The new cars are made to seat eight more passengers. The bodies and trucks are being built and supplied by the Brush Electrical Engineering Co., Ltd., and the electrical equipments are being supplied by the British Thomson-Houston Co., Ltd.

Japan.—PROPOSED ELECTRIC RAILWAY.—It is proposed to construct an electric railway, 460 km. in length, between Tokyo and Osaka, at a cost of Yen 100 mill. The route chosen will be 110 km. shorter than that followed by the existing steam railway. It is, according to *Weltwirtschaft*, doubtful if the Japanese Government will grant permission for the construction of the new railway, fearing its competition with the existing line.—*Economic Review.*

Leeds.—TRAFFIC DECREASE.—It is stated that, consequent upon the recent increase of ½d. on all fares, the passenger traffic has fallen off at the rate of half a million per annum.

London.—TUBE EXTENSION.—The Shepherd's Bush to Ealing (G.W.R.) extension of the Central London Electric Railway, has been completed and will be open to passenger traffic on August 3rd. We hope to give some particulars of the work in our next issue.

TRANSFORT CO-ORDINATION.—The Minister of Transport announces that at the request of the London County Council he arranged a conference between their representatives and the representatives of the Underground group of companies to discuss the relationship between the London County Council tramways and the other forms of London traffic, with the object of seeing whether it is possible to arrive at an agreement for co-ordinating and improving transport facilities in London.—*The Times.*

Middlesbrough.—STOCK.—The Corporation is asking the Ministry of Health for sanction to issue £1,250,000 stock. Of this, £150,000 is wanted for the acquirement of the tramways, and £22,100 for the electrical transporter bridge undertaking.

Northampton.—YEAR'S WORKING.—The balance-sheet of the Corporation tramways undertaking for the year ended March 31st, last, shows a total revenue of £68,776; traffic revenue was £67,089, against £47,020 last year, and revenue derived from carriage of parcels was £466, against £477, and from munitions £9, against £307. Working expenses totalled £55,634, against £40,368 last year; interest on capital, repayment of loans, reserve fund, &c., absorbed £11,745, leaving a surplus to be transferred to the reserve fund of £1,816; last year there was a deficit of £4,386. Car-miles run numbered 777,112, against 637,680; passengers carried numbered 12,061,793, against 10,273,748; and parcels carried numbered 46,833, against 43,402. The electricity purchased amounted to 809,851, an increase of 767,772 units, the cost being 1·89d. per unit. Electricity generated amounted to 615,932 units, a decrease of 688,376, the cost being 3·36d., against 2·14d. per unit last year.

Plymouth.—LOAN SANCTIONED.—The Ministry of Transport has sanctioned the borrowing of a total of £63,000 for the provision of new machinery and plant, 14 cars, and 20 motor-omnibuses.

FAILURE OF SUPPLY.—The failure of the supply to the tramways last week, which resulted in the system being suspended for an hour, was attributed by the chairman of the Electricity Committee to a large eel getting into a pump at one of the generating stations and choking it.

Radcliffe.—LOAN.—The Council is applying for sanction to borrow £1,725 in respect of its share of the cost of providing the necessary sub-station and equipment for the carrying out of the inter-connection of the systems of the Lancashire Electric Power Co., and the Bury Corporation Electricity Works at the Radcliffe electricity works.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—WIRELESS LICENCES.—The *Sydney Morning Herald* states that since the war, 900 wireless permits have been issued to universities, technical schools, wireless schools, and private individuals, and there are about 50 applications to be dealt with. Licences are now to replace permits. The fee for an experimental or instructional licence is £2 per annum, and for a vessel £1 per annum. Guarantees are required for the proper use of the installations.

Cable Delays.—The P.M.G., in reply to a question in the House of Commons, said that the greatest delay which had taken place during the last month so far as telegrams to the Continent were concerned was about 22¼ hours. This occurred on the traffic to Italy, which had been much congested owing to staff difficulties in that country. The average delay on telegrams to the Continent during the month was about 4½ hours. In the case of traffic forwarded to the Near and Far East, the maximum delay was about 24 hours, the average being about 10½ hours. To North America *via* the Imperial Cable the maximum delay was about 10 hours and the average about 3¾ hours.—*The Times.*

France.—WIRELESS TELEGRAPHY.—At the final sitting of the International Postal Conference held at Paris, it was suggested, says *The Times*, that wireless telegraphy should be used to a much greater extent for the dispatch of private telegrams.

Germany.—STATE WIRELESS.—The Department of Overseas Trade informs us that in order to supplement the ordinary telegraph system, and to serve as a substitute in special cases, *e.g.*, extensive breakdowns of the telegraphic communication owing to storms or to forcible damage, the German State Ministry of Postal Services has been engaged for the past year in establishing throughout the Empire a comprehensive State wireless system, which is being constantly extended. Some 16 transmitting and receiving stations, and 23 receiving stations, have already been established.

India.—REVISION OF RATES.—Increases of pay to the lower grades of Indian telegraph and postal servants will amount to over a crore of rupees (£1,000,000 approximately), and the public have been warned that the Government of India is considering a revision of inland postage rates.—*The Times.*

South America.—The Central and South American Telegraph Co. (All-America Cables, Inc.), has opened offices in Rio de Janeiro and Santos, and is now working the new cable laid from the Argentine Republic to those places. Rates have been reduced from 85 to 65 cents.

Thermionic Valves.—In the *Board of Trade Journal* for July 22nd, the Admiralty calls attention to the importance of the thermionic valve-making industry in Great Britain. The development of thermionic valves for wireless telegraphy increased enormously during the war, and it is believed that the quality of articles produced in Great Britain is now superior to that of any other country. It is contended that the United Kingdom produces a larger variety of standardised valves than other countries; high-power valves for any purpose requiring heavy oscillatory currents have been developed and standardised to an extent which is believed to be far in advance of that of any other country, and a higher standard of technical knowledge has been attained in the United Kingdom than abroad. A list of British manufacturers of these valves may be obtained from the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1.

United States.—NEW CABLES.—The *New York Times* states that the new cable being laid by the Western Union Telegraph Co. between Miami (Florida) and Barbados is to cost $5,000,000, and will be open for transmission of traffic on or about September 1st this year. The capacity of the cable is said to be 50,000 to 60,000 words a day, or 200/250 letters per minute. The cable is being manufactured in England. The above cable will connect at Barbados with a new cable being laid to Para, and all countries in South America will thus be in direct telegraphic connection with the United States by both the Central and South America Telegraph Co. "*via* Panama" and the joint new cables "*via* Barbados." The Western Union also, it is said, intends laying direct cables to the West Coast of South America.

WIRELESS OPERATOR'S WAGES.—The demand of wireless operators for increases of pay from $50 to $75 (£10 to £15) per month has been rejected. The extension, however, by 90 days of the present wage agreement has been agreed to by the Operators' Committee. Meanwhile it is understood that conditions of employment will be taken up and investigated by representatives of both sides.

Wireless Telephony.—DISTANCE RECORD.—The C.P.O.S. *Victorian*, which sailed from Liverpool on July 19th with the Empire Press delegates on board for Quebec, is said to have on board the most powerful wireless telephone installation yet installed on a passenger vessel. Transmission takes place on a wave length of from 1,800 to 2,400 metres, and the land station is Poldhu, Cornwall (3,500 metres wave length).

A new sea distance wireless telephone record was established on July 24th, when the passengers on board the liner, although separated by 300 land miles and 1,550 miles of sea, were able to enjoy a concert given by the Marconi station at Chelmsford. The concerts were continued daily until the ship reached Sydney, Nova Scotia, on the 27th. Telephonic communication between Newfoundland and the *Victorian* was established on the 25th over a distance of, approximately, 650 miles.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the **ELECTRICAL REVIEW**, *in which the "Official Notice" appeared.*

OPEN.

Belgium.—August 11th. The Société Nationale des Chemins de Fer Vicinaux, of Brussels (48, Rue Montoyer, Service Electriques) is inviting tenders until August 11th for the supply and laying of the armoured underground cables required (1) for the Brussels-Haecht line and (2) for the Gilly-Hansart line.

Birmingham. — September 1st. Salvage Committee. Two 100-KW., 440-v., D.C., compound-wound, steam-driven generating sets, complete with surface condenser and switchboard. (See this issue.)

Blackpool.—August 27th. Corporation. Two water-tube boilers, superheaters, economisers, stokers, &c.; two sets of induced draught plant; coal conveying, &c., plant. (July 16th.)

Bridgewater.—August 10th. Town Council Electric Light Installation. Town Hall and Municipal Buildings. Borough Surveyor. (Returnable deposit of £2 2s.)

Chile.—February, 1921. The Chilean Legation at Paris (23, Avenue du Bois de Boulogne) is asking for tenders for the supply and installation of electric power in the first zone of the Chilean railways. Sealed tenders are returnable before February 1st, 1921.

Cowdenbeath (FIFE).—August 4th. Electric Lighting of new school, Barclay Street. Mr. G. Campbell, Architect, Methil Brae, Methil. (Deposit of £1 1s. returnable.)

Grimsby.—August 12th. Electricity Department. Two water-tube boilers, economisers, fittings, fans, chimneys, &c.; one 3,000-KW. high-pressure turbo-alternator and condensing plant. (July 2nd.)

Manchester. — August 6th. Electricity Committee. Water pipes and valves, &c., for Stuart Street. (July 16th.)

August 13th. Electricity Committee. One each 75-ton and 15-ton electric cranes for Barton power station. (July 23rd.)

Nuneaton.—July 31st. Electricity Department. One 500-KW. rotary converter transformer and accessories. (July 2nd.)

Portsmouth. — August 17th. Tramways Committee. Stores for twelve months, including insulating materials, overhead line equipment, &c. (See this issue.)

August 25th. Electric Lighting Committee. One 4,000-KW. turbo-alternator; two water-tube boilers, each of 30,000 lb. per hour capacity. (See this issue.)

Uganda.—December 20th. Government of the Uganda Protectorate. Tenders invited for a concession of a portion of the Ripon Falls of the Nile for the development of power from 4,000 cubic feet of water per second for generation and distribution of electricity in the surrounding district and supply of electricity to townships of Jinja and Kampala and possibly Entebbe and to plantations en route. Information from the Crown Agents for the Colonies, 4, Millbank, London, S.W. 1, to whom tenders may be delivered by December 20th, 1920.—*Board of Trade Journal.*

Warrington.—August 10th. Electricity and Tramways Committee. Coal elevator and conveyor. (July 9th.)

CLOSED.

Barnes.—Electricity Committee. Recommended :—
Coal-handling plant—W. & D. Conveyor Engineering Co., Ltd., £2,542.

Bradford.—Electricity Committee. Accepted :—
Transformer repairs and test room—Burford, Taylor & Co.
Continuous-current meters.—Ferranti, Ltd.; and Chamberlain & Hookham, Ltd.

Gloucester.—United Schools. Governors :—
Lighting installation, Ribston Hall, Parsons Bros., £349

Government Contracts.—The following Government contracts were placed during June, 1920 :—

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT).

Gas-filled lamps.—British Thomson-Houston Co., Ltd.; Siemens Bros. & Co., Ltd.
Lamps.—A. C. Cossor, Ltd.; Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.; T. F. Braime & Co., Ltd.
Insulating materials.—H. Clarke & Co. (Manchester), Ltd.; Connollys (Blackley), Ltd.
Mica.—Attwater & Sons; Mica Manufacturing Co., Ltd.; F. W. Wiggins & Sons.

WAR OFFICE.

Electric crane.—J. Carrick & Son.
Crucibles.—Morgan Crucible Co., Ltd.
Junction boxes.—A. C. Cossor & Co.
Electric lamps.—General Electric Co., Ltd.

INDIA OFFICE: STORE DEPARTMENT.

Battery.—Hart Accumulator Co.
Electric cable.—Callender's Cable & Construction Co., Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.
Converters.—Bruce Peebles & Co., Ltd.
Globes.—Kitson Empire Lighting Co.; Sun Electrical Co.
Holders, brushes, &c.—Greenwood & Batley, Ltd.
Osram lamps.—General Electric Co., Ltd.
Lantern fittings.—Sun Electrical Co., Ltd.
Motors.—Lancashire Dynamo & Motor Co., Ltd.; Laurence Scott & Co.; Rees Roturbo Manufacturing Co., Ltd.
Pumping plant.—Worthington-Simpson, Ltd.
Switchboard.—British Switchgear, Ltd.
Telegraph and telephone sets.—Marconi Wireless Telegraph Co., Ltd.
Telephone exchange.—Automatic Telephone Manufacturing Co., Ltd.; Relay Automatic Telephone Co.
Bronze wire.—T. Bolton & Sons, Ltd.; F. Smith & Co.
Electric wire.—W. T. Glover & Co., Ltd.; London Electric Wire Co. & Smiths, Ltd.

POST OFFICE.

Accumulators.—Glasgow (Central) Telephone Exchange: D. P. Battery Co., Ltd.
Constructing manholes.—London-Southampton (South Midland section): R. M. Parkinson.
Laying conduits.—Birmingham (Stock Exchange P.O.): E. Jeavons & Co., Ltd. Barnet-Hornsey Junction: R. M. Parkinson. London-Bristol-Newport (South Midland, Section 3): Hodge Bros. (Contractors), Ltd. New Cross (Waller Road): G. J. Anderson. Dulwich (College Road) and Holborn (S.E. area): J. Mowlem & Co. Leeds-Harrogate (Section 3): Chandler Bros. Stepney, &c.: O. C. Summers. London-Bristol-Newport (South Midland, Sections 5 and 6): J. A. Ewart, Ltd.
Manufacture, supply, and drawing-in and jointing cable.—Heywood Loop: British Insulated & Helsby Cables, Ltd.
Power plant.—Devizes Wireless Station: Westminster Engineering Co., Ltd., sub-contractors for oil engines, Robey & Co., Ltd., for battery, Tudor Accumulator Co., Ltd. Caister Wireless Station: Westminster Engineering Co., Ltd., sub-contractors for oil engine, New Pelapone Co.
Telephone Exchange equipment.—Aberdeen and Belfast: Western Electric Co., Ltd. Clerkenwell (telephone school): Peel Conner Telephone Works, Ltd.
Protective apparatus.—Western Electric Co., Ltd.
Telephone apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.; Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Testing apparatus.—General Electric Co., Ltd.
Iron channel arms.—Bullers, Ltd.
Submarine cable.—Telegraph Construction and Maintenance Co., Ltd.
Telegraph and telephone cable.—Callender's Cable and Construction Co., Ltd.; Hackbridge Cable Co., Ltd.; Henley's Telegraph Works Co., Ltd.; London Electric Wire Co. & Smiths, Ltd.; Macintosh Cable Co., Ltd.; New Gutta-Percha Co., Ltd.; Siemens Bros. & Co., Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Leclanché cells.—Siemens Bros. & Co., Ltd.
Compound.—Dussek Bros. & Co., Ltd.
Cords for telephones.—London Electric Wire Co. & Smiths, Ltd.; Phœnix Telephone & Electric Works, Ltd.
Ducts.—Albion Clay Co., Ltd.; Doulton & Co., Ltd.; Mountford Phillips & Co., Ltd.; Sharp, Jones & Co.; Geo. Skey & Co., Ltd.; Stanley Bros., Ltd.; T. Wragg & Sons, Ltd.
Ear pieces.—North British Rubber Co., Ltd.
Insulators.—T. de la Rue & Co., Ltd.
Glow lamps.—British Thomson-Houston Co., Ltd.; Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.
Indicator lamps.—Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.
Cable distribution plugs.—British Insulated & Helsby Cables, Ltd.; Siemens Bros. & Co., Ltd.
Steel wire rope.—Whitecross Co., Ltd.
Lead sleeves.—G. Farmiloe & Sons, Ltd.; T. & W. Farmiloe, Ltd.
Tumbler switches.—General Electric Co., Ltd.
Copper tape.—Bodill, Parker & Co., Ltd.
Valve holders.—General Electric Co., Ltd.
Bronze wire.—British Insulated & Helsby Cables, Ltd.
Enamelled, rubber, and flame-proofed wire.—Western Electric Co.
Flame-proof wire.—British Insulated & Helsby Cables, Ltd.; Macintosh Cable Co., Ltd.
V.I.R. wire.—Hackbridge Cable Co., Ltd.

H.M. OFFICE OF WORKS.

Engineering services.—Hendon Vaccine Station, storage battery: Tudor Accumulator Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Cable.—Siemens Bros. & Co., Ltd.
Motor generator set, &c.—Premier Electric Welding Co., Ltd.
Meters.—Ferranti, Ltd.
Electric light poles.—J. Spencer, Ltd.
Switchboard, battery, &c.—Automatic Telephone Manufacturing Co., Ltd.
Telegraph line material.—Siemens Bros. & Co., Ltd.; Bullers, Ltd.
Telephones and Exchange apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.
Wheatstone apparatus.—Siemens Bros. & Co., Ltd.
Copper, G.I. and bronze wire.—Shropshire Iron Co., Ltd.; London Electric Wire Co. & Smiths, Ltd.
Insulated wire.—Siemens Bros. & Co., Ltd.

PUBLIC WORKS, DUBLIN.

Electrical works and supplies.—Belfast: A. Stevenson.

London.—HACKNEY.—Electricity Committee. Tenders for plant for extensions :—

(*a*) **Four water-tube boilers, 33,000 lb. per hour capacity, superheaters, mechanical stokers and driving gear, settings, flues, valves, mountings, dampers, &c.**

Babcock & Wilcox, Ltd. (accepted)	**£52,560**
John Thompson Water-Tube Boilers, Ltd.	56,097

(*b*) **Four induced-draught plants, with motor-fans, steel chimneys, dampers, &c.**

James Keith & Blackman Co., Ltd. (capacity too small)	£6,953
Davidson & Co., Ltd.	8,760
Babcock & Wilcox, Ltd. (Davidson fans) (accepted)	**8,780**
" " " (Musgrave ")	9,156
John Thompson Water-Tube Boilers, Ltd. (Davidson fans)	9,097
Musgrave & Co., Ltd.	9,701

(*c*) **Economisers :—**

Babcock & Wilcox, Ltd. (accepted)	**£12,116**
John Thompson Water-Tube Boilers, Ltd. (not in order)	11,449

(*d*) **8,000-10,000 KW. turbo-alternator, exciter, and air-filter or cooler :—**

Ateliers de Construction Oerlikon	£45,365
James Howden & Co., Ltd., & G.E.C., Ltd.	46,196
Escher, Wyss & Co., & G.E.C., Ltd.	48,451
Escher, Wyss & Co., & Ateliers de Construction Oerlikon	48,628
Richardson, Westgarth & Co., Ltd.	48,715
English Electric Co., Ltd.	48,760
British Thomson-Houston Co., Ltd.	49,065*
C. A. Parsons & Co., Ltd. (accepted)	**50,000**
Fraser & Chalmers Engineering Works, Ltd., & G.E.C., Ltd.	49,968
Metropolitan-Vickers Electrical Co.	58,750†

* Corrected from £15,918 owing to the inclusion of a special item which made comparison with other tenders impossible.
† This price includes a larger plant than asked for.

After due consideration, the tenders of three firms, Escher, Wyss and Co. & Ateliers de Construction Oerlikon, British Thomson-Houston Co., and C. A. Parsons & Co., Ltd., were selected for comparison.

The Committee considered that the offer of Escher, Wyss & Co. gave the best value, but in view of probable objections to the placing of the contract abroad, it was decided to accept the tender of C. A. Parsons & Co., as being on the whole the better of the two British offers. Messrs. Parsons expect to deliver in 58 weeks (turbine), and 62 weeks (alternator). The B.T.H. Co.'s period was 21 months. Escher, Wyss expected to be able to deliver in 11 months (turbine), and 14½ months (alternator).

(*e*) **Condensing plant, including condensers, air pump, augmenter, &c.**

Hick, Hargreaves & Co., Ltd. (accepted)	**£17,770**
Cole, Marchant & Morley, Ltd.	18,541
C. A. Parsons & Co., Ltd.	19,500
Worthington, Simpson Ltd.	20,063
English Electric Co.	21,910
W. H. Allen, Son & Co., Ltd.	23,498
Mirrlees, Watson & Co., Ltd.	22,900 26,700 27,500

(*f*) **Centrifugal vertical drive circulating water pumps; 840,000 gals. per hour, 30-ft. head.**

Rees Roturbo Manufacturing Co., Ltd. (accepted)	**£6,111**
W. H. Allen, Son & Co., Ltd.	6,820
Hick, Hargreaves & Co., Ltd.	10,500

(*g*) *Switchgear.*—**6,000-volt, three-phase switches, &c., on two 20,000-KW. coupler panels, one 10,000-KW. generator panel, six 2,000-KW., and one 4,000-KW. feeder panels for plant capacity 50,000 KW., &c.**

	Cellular types.	Armoured types.
Ferguson, Pailin, Ltd.	£10,393	..
New Switchgear Construction Co., Ltd.	10,776	..
Park Royal Engineering Works, Ltd.	14,500	..
A. Reyrolle & Co., Ltd. (accepted)	..	**£18,274**
Switchgear & Cowans, Ltd.	..	18,274
Bertram, Thomas	..	18,274
General Electric Co., Ltd.	19,205	..
Metropolitan-Vickers Electrical Co.	20,751	..
British Thomson-Houston Co., Ltd.	24,750	..

ST. PANCRAS.—**Electricity Committee.**

Six automatic coal-weighing machines, £410 each.—**W. T. Avery, Ltd.** (recommended).
The price for similar machines in 1916 was £241.

30-ton travelling crane for the King's Road station extension :—

Marshall, Fleming & Co.	**£3,365** (recommended)
A. Jack & Co.	3,430
Sir W. Arrol & Co.	3,513
Herbert Morris, Ltd.	3,750
J. Booth & Bros.	3,765
Babcock & Wilcox, Ltd.	3,885

Supply of pipes for 36-in. main between power-house and new pump house :—

Wicks & Dale	£2,920	delivery in 12 months
Alton & Co.	**3,014**	" 5 to 6 months (recommended)

Erection of coffer dam and river wall in connection with the new pump house :—

Somerville & Co., £2,100 + 10% for removal of excavating material (recommended).

L.C.C.—**Highways Committee.** Accepted. 4,000 driving-wheel tires, and 3,500 trailing-wheel tires for electric cars.

Brown, Bayley's Steel Works, Ltd., driving-wheel tires, £5 1s. 3d. each; trailing-wheel tires, £4 8s. 6d. each.
The list of firms submitting tenders included the Bochumer Verein Steel Works, offering to supply 800 driving-wheel tires at £6 10s. each, and 700 trailing-wheel tires at £4 10s. each.

STEPNEY.—**The Council has considered quotations for the supply of 440 yards of '5 sq. in. cable, as follows :—**

W. T. Henley's Telegraph Works Co., Ltd. (accepted)	**£325 10**
British Insulated & Helsby Cables, Ltd.	331 0

Leeds.—Electricity Committee :—

British Thomson-Houston Co., 12,000-KW. turbo-alternator condensing plant and accessories, £134,450, in connection with extensions (full scheme £730,000) at Whitehall Road Works.

Richmond-on-Thames.—Board of Guardians :—

Maintenance of electric lift, and third party insurance :—Marryat & Scott Ltd., £44 per annum.

Turkey.—Three British firms recently competed for the electric installation of the Haidar-Pasha Railway Terminus and its various dependencies—buildings, factories, &c., which had been put up for public tender, and one of the British firms succeeded in obtaining the important contract. There was keen competition among the various local electrical contractors of many nationalities for the contract.—*Reuter's Trade Service.*

Wallasey.—Corporation :—

Drake & Gorham.—Two electric tipping wagons, £2,882.

NOTES.

Post Office Training Classes.—On July 21st, the Right Hon. H. Pike Pease, M.P., Assistant Postmaster-General, visited the Post-Office factory at Holloway, to present prizes to the youths attending the Stores Department training classes. Mr. W. H. Allen, Controller of the Department, who took the chair, gave a brief description of the nature of the classes, and explained that they were carried on with the co-operation of the L.C.C. education authorities. All the instructors on the technical side were officers of the Department. In addition to the 300 boys who received training during the past session, 44 disabled ex-service men were also taught. Altogether 1,170 classes were held during the session, which ran from September to July. After presenting the prizes, consisting in the main of tools and books, Mr. Pike Pease heartily congratulated both instructors and pupils on the quality of the work produced. The proceedings concluded with votes of thanks to Mr. Pike Pease and the chairman. Many examples of the work done by the classes were on view. The exhibition displayed quite good workmanship, and included lathe tools, gauges, calipers, squares, Morse keys, buzzers, switches, &c., nearly all accompanied by the working drawings.

One Horse-Power.—The *Notts Express* publishes an illustration of a new type of house-lighting plant, designed by an "ingenious American." This involves a return to the "dark ages," as the invention consists of a geared generator operated by a horse traversing a 14-ft. circular track. It is claimed that sufficient electricity to light a farmhouse for a week can be generated in six hours, which is a very inexpensive way of "doing it electrically" if the R.S.P.C.A. has no objections.

Railway Wireless Communication.—In 1913 the Lackawanna Railroad Co., U.S.A., began the installation of wireless telegraph and telephone apparatus for the purpose of establishing communication between terminal stations and moving trains, and with the object of providing a means of communication between main stations at times when the regular wire lines might be out of commission. At the time when the U.S.A. entered the war, the company had made considerable progress in the new undertaking, and the service, particulars and illustrations of which were given in our issues of March 20th and August 14th, 1914, had reached a point of reliability where, according to the *T. & T. Age*, a considerable volume of business was being satisfactorily handled. When the Government, for war purposes, prohibited all private use of wireless, the Lackawanna installations were dismantled. Towards the end of last year, however, when the ban was lifted, the company took up the work once more, and this time it had available to ensure success the numerous improvements that have resulted from the development of wireless signalling during the war.

Fatality.—At the new works of Messrs. Cammell, Laird and Co., Penistone, on July 20th, a fitter, named Herbert Clough, accidentally put his hand on a live wire while on a crane, and immediately the switch was opened by fellow workmen he dropped a distance of 16 ft., and received injuries which proved fatal.

Lignite in Ulster.—The company which has been making extensive borings for lignite in the vicinity of Glenavy, on the shores of Lough Neagh, has purchased considerable property over which the borings were made. Lignite has been found on several farms, and these have been purchased from the owners. The specimens obtained seem to be of higher specific gravity than the English and Scottish specimens, and were obtained at a depth of from 100 to 130 ft. It has long been known that there is a tract of lignite running from the Tyrone shores to Lough Neagh, right under the Lough to the Antrim side, but the borings on the latter seem to have been more successful. Lignite represents the intermediate state between peat and coal, and is known in some places by the name of "brown coal."

Anglo-American Exchange of Students.—The British Thomson-Houston Co., Ltd., has decided to establish two scholarships, one of which will be allotted to Cambridge. It proposes to select from the engineering graduates of that University who have worked with the firm for not less than six months a scholar who will be sent to the International General Electric Co., with which is associated the General Electric Co. of New York. The company proposes to allow for the student's expenses for one year an equivalent of $1,800 (about £470) in gold. After a year's study in America he will be expected to return to the British company strengthened by the experience he has gained on the other side of the Atlantic.—*The Times.*

Training Disabled Men.—The exhibition of work done by partially-disabled ex-service men, which was held by the Ministry of Labour during the past week at the Central Hall, Westminster, was of quite exceptional interest. A great number of trades were represented, and the work shown was of a very high standard. Electrical exhibits were shown at the stands of the Government Instructional Factory, Hackney, and of the South-Eastern Counties, where the Croydon Central Polytechnic and Wimbledon Technical School were well represented.

The Hackney workshops are conducted by the acting-manager, Mr. Philip Wrigley, A.M.I.E.E., who has 165 men in course of training, with room for a total of 250. The course began in February last, and as supplies of electrical material were wanting, the men were started on elementary bench and lathe work, making small tools, &c., of which excellent examples were exhibited, showing a remarkable degree of accuracy and finish. The shops are divided into four departments—namely, meter repairing, electrical fitting, electrical contractors' work, and armature winding. At the Exhibition the whole of the wiring for light and power was done by the Hackney trainees, including a striking illuminated sign over the stand. A prominent feature of the exhibit was the winding of coils on formers and of armatures with the coils, which was actually in progress; a finished armature, wound by two men in four days after a very brief period of instruction, offered little scope for criticism. Preliminary instruction is given in making and reading drawings, and in electro-technology generally, and the quality of the work indicates that the results are highly satisfactory.

We have previously described and illustrated the admirable arrangements for training men at the Central Polytechnic of the Croydon Education Committee, under the guidance of Mr. F. H. Taylor, A.M.I.E.E. (ELECTRICAL REVIEW, May 9th, 1919); the exhibits show that the efficiency of this Training Centre is maintained at a high level. A charging board designed and made by two of the trainees enables up to 6 batteries requiring 1, 2, 3, 4, 5, or 6 amperes to be charged simultaneously with the use of only 6 resistance lamps and 6 switches and fuses, the power consumed never exceeding that required for the largest battery, as the batteries are all in series. An ordinary charging board with 15 lamps, all controlled by 4 switches, gives 15 different charging currents. Other exhibits include a complete starting panel mounted on Welco frames, 2- and 3-core concentric cables fitted with tails in dividing boxes, a set of three right-angle bends in ¾-in. conduit, faultlessly concentric and made against time by hand, as well as a perfectly regular set of 7 conduits off-set into a distributing box, a complicated sample of tube-bending to illustrate 3-point control, tubing and switch-boxes sunk into a wall and nicely finished, a demonstration board showing the 3-wire system with 2 4-volt batteries and miniature lamps, drawings, mitred joints in casing, &c., and not least interesting, letters from employers expressing satisfaction with the trainees, and from the latter expressing their appreciation of the help afforded them. Some 160 men have passed through this Centre, and Mr. Taylor is to be congratulated on the good work done.

The Wimbledon Technical Institute showed the drawings, finished parts, and completed instruments of moving-iron ammeters and voltmeters made at the Institute—the only purchased parts being the hair-springs and some small screws. Other exhibits were a variety of turning tools, lathe centres and dogs, clamps, a detector galvanometer, electromagnets, &c., all showing a high standard of workmanship. Wiring work and other trades, including wireless operation, are taught at the institute.

When it is borne in mind that the exhibits are all the work of men more or less severely injured in the war, and now taking up new callings, the efficiency both of the instructors and of the learners will be appreciated.

Ramsay Memorial Fund.—The Executive Committee of this Fund has decided to close it, the total receipts having amounted to £53,402. In addition, Dominion and foreign Governments have founded scholarships estimated as equivalent to a capital value of £30,000. The trustees have elected Mr. W. Davies, M.Sc., of Manchester, to a Fellowship.

Iron and Steel Institute.—The following arrangements are announced in connection with the Cardiff meeting:—Monday, September 20th, registration of members and issue of badges. September 21st, general meeting of members, and a visit to the Dowlais works of Messrs. Guest, Keen & Nettlefolds, Ltd., and to Bute Docks. September 22nd, general meeting and reading of papers. Luncheon at the City Hall, given by the chairman and directors of Messrs. Guest, Keen & Nettlefolds, Ltd. Visits in afternoon to Alexandra Docks, Newport, and Barry Docks. September 23rd, visits to Ebbw Vale Steel, Iron and Coal Co.'s works and the Chepstow shipyards of the Monmouth Shipbuilding Co. September 24th, visits to the Margam Iron and Steel Works, Port Talbot, and various works at Swansea. Among the papers to be submitted are:—"Electric Steels," by C. G. Carlisle, and "The Electrification of the Works and Collieries of the Ebbw Vale Co.," by W. Dixon.

Service Notes.—A/Capt. R. M. Moberly, from East Riding Fortress Engineers, to be captain, T.F. Reserve, R.E. Extract from the *London Gazette*, June 30th, 1920.

Appointments Vacant.—Assistant divisional engineer for telegraphs and telephones for the Post and Telegraph Department, Penang (360 dollars per month, dollar = 2s. 4d.); telegraph engineering assistants for the Government of Tanganyika Territory, Post and Telegraph Department (£350). See our advertisement pages to-day.

Joint Housing of Technical Societies.—According to Sir W. Pope, of Cambridge University, an appeal for funds is about to be made, under the leadership of Lord Moulton, to build headquarters to house all the various interests, scientific, technical, and commercial, of the county.

Educational.—UNIVERSITY GRANTS.—Lord Crawford stated in Parliament, on July 21st, that, subject to the over-riding necessities of national finance, the Chancellor of the Exchequer was prepared to submit to Parliament an increase in the present vote to the universities of from one to one-and-a-half million pounds in the Estimates for 1921-22.

Lord Rayleigh Memorial.—The Rayleigh Memorial Committee has decided that the memorial to the late Lord Rayleigh in Westminster Abbey shall take the form of a mural tablet, by Mr. Derwent Wood. The balance will be used to establish a library fund at the Cavendish Laboratory, Cambridge.—*The Times.*

Rapid Development in Detroit.—The United States census shows that the City of Detroit has in 10 years doubled its population, which now numbers nearly a million. The Detroit Edison Co. (chief engineer, Alex. Dow) in 1909 sold 87 million KW.-hours; in 1919 the output was not double, but *more than ten times* as much—872·5 millions a year. There are two main generating stations, at Delray and Connors Creek.

Municipal Tramway Managers.—The Huddersfield Tramways Committee has decided to invite the Association of Municipal Tramway Managers to hold their conference next year at Huddersfield

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Lieut.-Col. G. F. MILLS, D.S.O., M.I.M.E., M.I.A.E., has been appointed chief engineer to the Aster Engineering Co. (1913), Ltd.

For the appointment of borough electrical engineer at Southampton there were 54 applicants. These were reduced to six, who were interviewed by the committee, with the result that Mr. W. G. TURNER, chief assistant engineer, Newcastle and District Electric Lighting Co., Ltd., has been appointed.

Kingston-on-Thames T.C. is recommended to increase the salary of the electrical engineer from £600 to £750; that of the chief assistant from £400 to £587, and those of the five shift engineers from £255 to £303.

Aylesbury T.C. has increased the salary of the electrical engineer (Mr. W. A. TURNBULL) from £400 to £485 a year; and that of his assistant (Mr. WEST) from £130 to £155.

The Mexborough Urban District Council has succeeded in making an exhibition of itself. On Friday last Mr. J. E. Cliff moved a resolution rescinding the decision of the Council to increase the salary of the electrical engineer, Mr. FELTHAM. He said he had no feeling against that official, but he contended that Mexborough could not afford to pay the proposed salary. Mexborough was on the verge of bankruptcy, and he hoped the Council would consider seriously before giving an official £13 per week, which, with emoluments, was brought to £15 a week. He had no doubt that the electrical engineer was worth the salary in a larger town, but Mexborough could not afford it. Mr. H. Cliff seconded the resolution. Mr. W. Winstanley pointed out that Mr. Feltham had increased the number of units almost threefold, and he had also increased the revenue of the electricity undertaking from £5,900 to something approaching £15,000 a year. The chairman of the Electricity Committee hoped for the sake of their own honour the Council would not repudiate an honourable agreement. Ultimately the resolution to rescind the minute was carried by six votes to five.

Mr. L. G. CAUNTER has retired from the board of Baxter and Caunter, Ltd., owing to ill-health. Mr. G. W. Kettlewell has again taken up his duties of director of the company after an absence of three years, during which time he was engaged upon war work.

Mr. J. WRIGHT, chief engineering assistant to the Bradford Corporation, has been appointed deputy city electrical engineer from August 1st next, at a salary of £1,000 a year, providing that he does not leave the Corporation's service before March, 1922.

Mr. T. G. RICHARDSON, manager of the Colne Corporation light railways, has been appointed general manager of the West Hartlepool Corporation Tramways and omnibus undertaking.

Mr. J. MENZIES, on leaving Dundee to become tramway manager at Kilmarnock, has been presented by the tramway staff with a wallet of Treasury notes.

Mr. H. W. DEVEY, of the power station staff (charge engineer) of the Metropolitan Railway, has been appointed assistant electrical engineer to a large undertaking in Spain.

Mr. E. H. SPICER, who has been a director of Spicer & Co., Ltd., for many years, and who was the hon. secretary of the Electrical Accessories Association until that association was merged into the Electrical Importers' and Traders' Associa-

tion, has resigned from the board of the company, and has commenced business for his own account under the name of The Power Utilities Co., at 158, City Road, London, E.C.

With further reference to a notice that appeared in this column last week we are informed that Mr. E. T. RUTHVEN MURRAY has resigned his appointment as general manager and engineer to the North Metropolitan Electric Power Supply Co. to engage in private practice as a consulting engineer. His address will still be Manor House Offices, Finsbury Park, N.4, as in future his connection with the North Metropolitan Electric Power Supply Co. will be that of construction engineer.

Marylebone B.C. Electric Supply Committee, having considered the position of the Council's chief electrical engineer, Mr. C. H. SMYTH, finds that he is the only officer of the Council who has not participated in some manner in the bonus schemes to meet the extra cost of living which have been granted from time to time to the various grades of the Council's service, and that he is now in the present altered circumstances receiving only the amount of remuneration which was paid to the chief electrical engineer for many years before the war. It recommends that award No. 101 as modified by the report of the Civil Service National Whitley Council Cost of Living Committee be made applicable to Mr. C. H. Smyth as from the 1st of March, 1920.

Mr. F. C. MCQUOWN, secretary of the County of London Electric Supply Co., Ltd., was presented with a silver rose bowl and salver by the staff on the completion of 21 years' service with the company.

Obituary.—MR. J. S. NICHOLSON.—Mr. John Steel Nicholson, lecturer on electrical engineering at Glasgow University, died on Friday, at the age of 40 years, after a serious illness. Mr. Nicholson recently wrote a thesis which was accepted for the degree of D.Sc., but his illness prevented him being capped. During the war he rendered valuable service in the Airship Department in London, and he received the O.B.E. He had held his appointment as lecturer on electrical engineering since 1906.

MR. JAMES MITCHELL.—The death is reported of Mr. James Mitchell, president of the Alabama Traction, Light & Power Co., Ltd. During his career he had been largely interested in hydro-electric and other electrical enterprises, including the Rio de Janeiro Tramway, Light & Power Co., Ltd., and the São Paulo Electric Co.

MR. G. F. DAVIDSON.—The death occurred suddenly on Saturday last, while engaged at his office, of Mr. George F. Davidson, managing director of Messrs. Wallis & Watson, Ltd., electrical engineers, of Park Row, Leeds. He was 44 years of age. He had recently suffered from a severe illness.

NEW COMPANIES REGISTERED.

Marine and Mechanical Electric Welding Co. (Cardiff), Ltd. (169,074).—Private company. Registered July 16th. Capital, £30,000 in £1 shares. To carry on the business indicated by the title, and to adopt an agreement with the Marine and Mechanical Electric Welding Co., Ltd. The first directors are: C. M. Burls, 4, Lloyd's Avenue, E.C.3; T. McLellan, "Oakdene," Gordon Road, Finchley, N.3; A. Woodward, 6, Palmerston Road, East Sheen, S.W.; W. Pollock, 3, Lloyd's Avenue, E.C.3. Qualification, £500. Secretary: W. S. Keith. Registered office: 3, Lloyd's Avenue, E.C.3.

Garnet Tucker & Co., Ltd. (11,341).—Private company. Registered in Edinburgh July 16th. Capital, £5,000 in £1 shares. To carry on the business of electrical and mechanical engineers, manufacturers of and dealers in electrical and gas apparatus and steam boilers, &c. The subscribers (each with one share) are: A. G. Tucker, 133, West Campbell Street, Glasgow, electrical engineer; W. Craig, 190, St. Vincent Street, Glasgow, solicitor. The first directors are: A. G. Tucker, W. Craig and S. R. Woodger. Registered office: 133, West Campbell Street, Glasgow.

Radio Clubs, Ltd. (169,130).—Registered July 19th. Capital, £10,000 in £1 shares. To establish, maintain and conduct clubs for wireless telegraphists, cable-telegraph operators and others; to give special privileges to the Association of Wireless Telegraphists and the Cable-Telegraph Operators' Association. The first directors are: E. R. Tuck, 3, Warwick Road, Ealing, W.; E. A. Watkinson, 58, Southborough Road, Hackney; C. J. McCarthy, 48, Elvetharn Road, Edgbaston, Birmingham. Minimum cash subscription, seven shares. Secretary: G. W. Pacy. Registered office: Hastings House, Norfolk Street, Strand, W.C.

Gratze, Ltd. (169,151).—Private company. Registered July 20th. Capital, £30,000 in £1 shares. To carry on the business of electrical, mechanical, automobile, aeronautical and marine engineers, manufacturers of and dealers in electric, magnetic, telegraphic, telephone and other appliances, &c. The permanent directors are: E. V. H. Gratze (managing director), "Ulidia," Wardstock Avenue, Hendon, N.W.4; F. Clayton, 15, Hanover House, Regent's Park, N.W.1. Registered office: 44-6, Whitfield Street, W.1.

Alkaline Miners Lamp, Ltd. (169,139).—Private company. Registered July 20th. Capital, £10,000 in £1 shares. To carry on the business of manufacturers of miners' electric lamps, electrical and mechanical engineers, &c., and to adopt an agreement with G. Pearson. The first directors are: J. A. Taylor, The Manor House, Mansfield, Woodhouse, Notts (director, Sherwood Colliery Co., Ltd.); F. N. Ellis, Debdale Hall, Mansfield, Notts (director, Sherwood Colliery Co., Ltd.); G. Pearson, 1, Lancaster Gardens, Southend-on-Sea. Secretary: F. H. Ellis. Registered office: 14, Fletcher Gate, Nottingham.

London Factors and Agents, Ltd. (169,125).—Private company. Registered July 19th. Capital, £200 in 5s. shares. To take over the business of an electrical and general merchant carried on by F. P. Sexton at 50, Parliament Street, Westminster, as the "London Factors and Agents." The subscribers (each with one share) are: F. P. Sexton, 16, Market Place, Kingston-on-Thames, electrical engineer; F. L. Strausons, 159, Richmond Road, Kingston, merchant. F. P. Sexton is permanent governing director. Solicitor: C. G. Sherwood, 53, Eden Street, Kingston-on-Thames.

Bristol and South Wales Electric Welding Co., Ltd. (169,144).—Private company. Registered July 20th. Capital, £5,000 in £1 shares. To carry on the business indicated by the title. The subscribers (each with one share) are: F. Sandiford, 1, Kensington Avenue, Victoria Park West, Cardiff, clerk; W. C. Buck, 33, Borstal Avenue, Heath, Cardiff, engineer. The subscribers are to appoint the first directors. Qualification, 100 shares. Secretary: F. Sandiford. Registered office: 236, Bute Street, Cardiff.

Atlantic Engineering Co. (1920), Ltd. (11,336).—Private company. Registered in Edinburgh July 13th. Capital, £350,000 in £1 shares (175,000 preference). To take over the British patent rights granted to T. Morton relating to the lubrication of engines; the business carried on by the Atlantic Land and Marine Engine Co., Ltd., at Wishaw; and the business carried on by the British Marine Motor and Launch Co., Ltd., at Old Kilpatrick, and to manufacture internal combustion engines and parts thereof, engines for driving electrical generators, pumps, air fans or other mechanical apparatus, &c. The subscribers (each with one share) are: T. Morton, Atlantic Works, Wishaw, engineer; W. H. Howden, 195, Scotland Street, Glasgow, engineer. The first directors are: T. Morton, W. H. Howden, J. H. Hume, J. B. McGillivray, J. Morton, W. Morton and M. B. Auld. Qualification, £500. Remuneration, £1,000 per annum for services, other than managing director. Solicitors: M. Boyd Auld and Hunter, 113, St. Vincent Street, Glasgow.

Brighton Lighting and Electrical Engineering Co., Ltd. (169,143).—Private company. Registered July 20th. Capital, £5,000 in £1 shares. To carry on the business of electrical, mechanical and general engineers, suppliers of electricity, manufacturers of and dealers in electric, magnetic, galvanic and other apparatus and machinery, &c. The subscribers (each with one share) are: E. Heaps, 3a, Church Street, Brighton, engineer; H. Banks, 5, Hartington Road, Brighton, electrical engineer. E. Heaps is first managing director. Registered office: 46, Old Steine, Brighton.

Todman Ryall & Co., Ltd. (169,218).—Registered July 22nd. Capital, £25,000 in £1 shares. To carry on the business of manufacturing, electrical, mechanical, motor and general engineers, &c. The subscribers (each with one share) are: J. C. Todman, 29, Goldsmith Avenue, W.3, engineer; R. T. H. Ryall, 40, Forest Road, Kew Gardens, Surrey, engineer; W. J. Whinfield, 16, Montreal Road, Ilford, secretary; J. Davidson, "Elleralie," Eltham, S.E.9, share broker; J. P. J. Peregrine, 54, New Broad Street, E.C., company director. Registered without articles of association. Solicitors: Geo. Reader and Co., 35, Coleman Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bell's United Asbestos Co., Ltd.—Issue on May 1st, 1920, of £10,000 debentures, part of a series already registered.

Hart Accumulator Co., Ltd.—Debenture dated July 5th, 1920, to secure £35,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holders: London County, Westminster & Parr's Bank, Ltd.

Frank Tomey & Co., Ltd.—Satisfaction in full on July 12th of mortgage dated March 20th, 1920, securing all moneys due or to become due from company to bankers.

Sir W. G. Armstrong, Whitworth & Co., Ltd.—Trust deed dated July 5th, 1920, to secure £2,000,000 debenture stock and further unlimited issue charged on various properties in Elswick and Benwell, Newcastle-on-Tyne, and Openshaw, Lancs. (subject to prior deed for £2,500,000 debenture stock) and the company's undertaking and property, present and future, including uncalled capital. Trustees: Law Debenture Corporation, Ltd.

Heswall Electric Light Co., Ltd. (55,482).—Return dated June 11th, 1920. Capital, £1,500 in £1 shares. 1,225 shares taken up. £1,225 paid. Mortgages and charges: nil.

Hendon Electric Supply Co., Ltd.—Trust deed dated July 12th, 1920 (supplemental to trust deeds dated July 30th, 1907, and April 2nd, 1912) to secure £25,000 debenture stock, in addition to £33,000 secured by previous deeds. Property charged: the company's undertaking and property, present and future, including uncalled capital. Trustees: Beaver Trust, Ltd.

CITY NOTES.

Stratford-on-Avon Electricity Co., Ltd.

Meetings of the debenture holders and shareholders have been held to consider what course could be taken to enable the company to end the present unsatisfactory state of affairs. The chairman said that if money could not be obtained to carry on with, either the works would have to be closed, or something would have to be done with them. Last Christmas, in order to keep things going, the directors supplied money out of their own pockets to pay interest to the debenture holders. That could not continue, and the bank would not honour the company's cheques unless the debit balance was reduced, or unless the directors gave a personal guarantee. That they did not feel inclined to do. The negotiations with the Corporation for the purchase of the undertaking were abortive. The only bright spot on the horizon was that the prospects of the company were never better. In the course of the chairman's speech and the subsequent discussion, it transpired that new mains to replace the existing ones were necessary at once, and the meeting was asked whether the shareholders could raise £10,000 to bring the undertaking up-to-date, as if not, the concern must come to an end. It was decided to visit the Board of Trade and ascertain just how they stood in regard to being allowed to wind up, and other matters, and to see whether any help could be derived from that source. Failing that, another meeting will be called to pass resolutions as to winding up.

German Companies.

The A.G. fur Elektrotechnische Unternehmungen, of Munich, recommends a dividend of 6 per cent. on the preference shares for 1919, as in the previous year.

The directors of *Dr. Paul Meyer A.G., of Berlin*, recommend a dividend at the rate of 10 per cent. out of net profits of 675,000 marks in 1919, as contrasted with 10 per cent. and 437,000 marks in 1918.

The Continentale Gesellschaft fur Elektrische Unternehmungen, of Nuremburg, proposes to pay a dividend at the rate of 3 per cent. on the preference share capital of 31,122,000 marks for 1919, being the same rate as in 1918. The net profits are returned at 1,318,000 marks, as against 1,212,000 marks.

The accounts of the *C. Lorenz, A.G., of Berlin,* show that after setting aside 1,151,000 marks for depreciation in 1919, as against 1,903,000 marks in the previous year, the net profits amount to 1,568,000 marks, as compared with 1,224,000 marks in 1918. It is proposed to pay a dividend and bonus of 20 per cent., contrasting with 22 per cent. in 1918.

The directors of the *Akkumulatoren Fabrik, A.G., of Berlin-Hagen,* recommend a dividend at the rate of 17 per cent. for 1919, this comparing with 20 per cent. in the previous year. It is proposed to increase the share capital by 8 to 20 millions of marks; one half of the new shares will be offered to existing shareholders at the price of 150 per cent., while the remainder will be devoted to an interchange of shares with other companies.

The A.G. Mix & Genest, of Berlin-Schoneberg, after allocating 107,000 marks to depreciation in 1919, as compared with 118,000 marks in the preceding year, reports net profits of 653,000 marks, as contrasted with a loss in 1918 in consequence of the cancellation of army orders and labour troubles. The directors recommend a dividend at the rate of 7 per cent., as against no distribution in 1918. It is added that the orders on hand will provide full occupation for the present year.

The report of the *Deutsche Kabelwerke, A.G., of Berlin-Lichtenberg,* states that sale prices in 1919 did not keep pace with the growth in working expenses. After making provision for depreciation, the net profits are returned at 1,392,000 marks, as compared with 856,000 marks in 1918, and a dividend at the rate of 10 per cent. is to be paid as in the previous year, together with a bonus of 5 per cent. for 1919. It is stated that the capital invested in the English subsidiary company will be received this year on the basis of the "exchange adjustment law."

The report of the *Elektrizitats A. G. Vorm. W. Lahmeyer & Co., of Frankfort-on-Main,* gives a review of the situation of the tramways and electricity works in which the company is interested, and mentions that the holdings in the German Transmarine Electricity Co. and the Felten & Guilleaume Co. have been sold. After making provision for depreciation and meeting the loan service, the accounts show net profits of 3,015,000 marks for 1919, as compared with 2,848,000 marks in the previous year, and the dividend is at the rate of 8 per cent., as in 1918, on ordinary share capital of 34,375,000 marks.

The directors of the *Felten & Guilleaume Carlswerk, A.G., of Cologne-Mulheim,* reporting on the past year, state that owing to the scarcity of coal it was only possible partly to meet the demands made upon the works. Great difficulties were experienced in obtaining raw materials for the manufacture of products of the quality produced in former peace times, as most of the materials had to be obtained from abroad, and even semi-finished steel had to be imported, as inland makers were unable to satisfy the most urgent requirements. Thanks to the appropriate adaptation of manufacturing to more highly finished products, as compared with the pre-war period, it was possible to find occupation for workmen and staff to approximately the same extent as formerly, and as soon as the market was open the policy followed for ten years past of strengthening the internal finances enabled the company to acquire sufficient quantities of copper, rubber, woven materials, &c.—as being the most essential raw materials. The great increase in sale prices resulting from the favourable situation contributed towards the profits for the year. The holding of shares in the Steinfort steel works was no longer possible owing to the conditions in Luxemburg, and the shares had therefore been sold to a French company, and the most important problem for the company would be to find substitution for this loss of supply of semi-finished steel. As gross profits the accounts indicate the sum of 29,561,000 marks, as compared with 22,638,000 in 1918, and net profits and balance forward amounting to 10,139,000 marks, as against 6,767,000 marks in 1918, amounts of 1,418,000 marks and 3,717,000 marks having been previously written off for depreciation in the two years respectively. It is proposed to pay a dividend at the rate of 15 per cent. on ordinary share capital of 60,000,000 marks, this contrasting with 10 per cent. in 1918, 15 per cent. in 1917, and 8 per cent. in 1914. The share capital is now to be increased to 122,000,000 marks.

French Companies.

At the ordinary meeting of the *Energie Electrique du Littoral Méditerranéen* the net profits were stated to be 4,910,462 fr., allowing of the distribution of a dividend of 6 per cent., the same amount as in the two preceding working years. The report emphasised in much detail the difficulties met with in working the company connected with the crises in transport and coal, occasioned by strikes, and stated that the year recorded the greatest rise in expenditure since the beginning of the company. In approving the accounts and report, the meeting fixed the dividend at 30 fr. per security.

The *Compagnie des Produits Chimiques d'Alais et de la Camargue* (at Pechiney) and the *Société Electro-métallurgique Française* (at Froges) are, it is said, about to amalgamate. The former company has a remarkable record in the French chemical and metal-working industry. In late years it has devoted itself specially to aluminium. In 1911 it took a 33.7 per cent. share in the Aluminium Français Company. In 1914 it absorbed the Société des Produits Electro-Chimiques et Métallurgiques des Pyrénées. In 1916 it absorbed the Société des Forces Motrices et Usines d'Arve. Its amalgamation with the Froges Company is not the least chapter of its remarkable record, for that company takes rank as one of the largest French producers of aluminium. Before the war its yearly output was about 5,000 tons. Besides its works at Froges, it owns works at Argentière, on the Durance River, the Praz, and the St.-Michael-de-Maurienne, on the Arc—all three works using the alumina made in another works of the company, seated at Gardanne, for conversion into aluminium. Moreover, the Froges company owns a mine of bauxite on the Var which furnishes 90 per cent. of its consumption.

Realising net profits of 1,132,625 fr., the *Electricité de Strasbourg Co.* have declared a dividend of 5 per cent., or 62.50 fr. per share. The report foresees the need for the installation of new lines and the enlargement of the central station to meet the demand for energy. A high-tension line to link Mulhouse to Strasbourg is now under construction, with low-tension offshoots to serve a certain number of communes.

With net profits of 613,515 fr., the *Apareillage Electro-industrial* (Petrier, Tissot et Raybaud) have distributed a dividend of 103 fr. per share to the old shareholders and 16.40 fr. to the new shareholders, created by the recent increase of capital (500,000 fr.).

The shareholders of the *Société des Forces Motrices d'Auvergne* have sanctioned a dividend of 6 fr. per share. Notwithstanding existing difficulties, the management have decided to install a new reserve central station at Thiers, equipped with two 600-H.P. Diesel sets.

Austrian Companies.

The accounts of the *A.E.G. Union Elektrizitats Gesellschaft, of Vienna,* show a large increase in the gross profits in 1919, as compared with the preceding year. After placing 1,660,000 kr. to depreciation, as against 720,000 kr., the net profits are returned at 2,419,000 kr., as contrasted with 1,490,000 kr. in 1918. It is proposed to pay a dividend at the rate of 8 per cent., as compared with 5 per cent. The report mentions that the share capital in the new financial year has already been increased from 24 to 36 million kr., and a further advance to 50 millions has been decided upon. An abundance of contracts is on hand, including State orders for hydro-electric works, and the conversion of the Alpine railways to electric traction.

The report for 1919 of the *Austrian Siemens-Schuckert Werke, of Vienna,* states that the works were well occupied, but the production suffered from difficulties in working and transport. The transition to peace manufactures proceeded without interruption, although the depreciation of the currency rendered it almost impossible to procure raw materials from abroad. Having written off 1,400,000 kr. for depreciation, as against 1,600,000 kr. in 1918, the accounts show net profits of 2,950,000 kr., as compared with a loss of 243,000 kr. in the previous year, and the dividend is at the rate of 5 per cent. on capital of 32,000,000 kr., this contrasting with no distribution for 1918. It is stated that sufficient orders are now on the books, and sale prices have almost reached the world's market prices. The share capital has been increased to 75,000,000 kr. At the end of 1919 the number of workmen and staff was 5,354, comparing with 5,092 at the close of 1918.

Stock Exchange Notices.—Dealings in the following securities have been specially allowed by the Committee under Temporary Regulation 4 (3):—

Johnson, Matthey & Co.—£250,000 8 per cent. 7-year notes, issued at £97½ per cent., fully paid, after issue of allotment letters.

South Metropolitan Electric Light & Power Co.—500 7 per cent. cumulative first preference shares of £1 each, fully paid, Nos. 292,969 to 293,468.

Tramways Light & Power Co.—502,100 ordinary shares of £1 each, fully paid, Nos. 1 to 502,100. 247,900 new ordinary of £1 each, Nos. 502,101 to 750,000.

The Committee has ordered the following to be officially quoted:—

Marconi's Wireless Telegraph Co., Ltd.—1,385,726 ordinary shares of £1 each, fully paid (Nos. 1,500,001 to 2,885,726).

Telephone Manufacturing Co. (1920), Ltd.—Mr. F. T. Jackson presided at the statutory meeting held on Friday. He described the objects and operations of the company, and the intention to extend the selling organisation throughout the world. In addition to the installation companies operating in this country they controlled others in Belgium and France, and had contracts with firms in Spain and Egypt; they were starting a company in Australia, and as soon as the factory extensions were completed, they would be developing their business in practically every civilised country.

Metropolitan Railway Co.—Interim dividend for the half-year at the rate of 1 per cent. per annum on the consolidated stock, including the deferred ordinary stock; also interim dividend on the surplus land stock at the rate of 2½ per cent. per annum.

Liverpool Overhead Railway Co.—Interim dividends for the half-year ending June 30th at the rate of 5 per cent. per annum on the preference shares, and 2½ per cent. per annum on the ordinary shares.

Prospectuses.—*Bullers, Ltd.*—The list of subscriptions is to close on or before tomorrow, in an issue of £250,000 first mortgage 6 per cent. (free of tax) redeemable debentures of £50 and £100 each. The proceeds are required to replace expenditure incurred in the erection and equipment of the new works at Milton, and to provide additional working capital. The net profits for the past four years subject to E.P.D. and income tax have been: 1916, £41,794; 1917, £71,461; 1918, £52,488; 1919, £71,021, and the dividends for these four years were 7½ per cent., 10 per cent., 10 per cent., and 12½ per cent., free of tax, on the ordinary shares.

The Telephone Manufacturing Co. (1920), *Ltd.*—This company is offering until August 4th an issue of 100,000 ordinary shares of £1 each at par. It was formed in May last to take over a complete organisation for the manufacture, installation, and maintenance of the "New System" intercommunication telephones. The company acquires the business and assets of the Telephone Manufacturing Co., Ltd., and the entire issued share capital of 13 allied installation companies which are carrying on operations in different parts of the United Kingdom. It is stated that contracts already entered into provide a yearly rental exceeding £75,300. The works are at West Dulwich, and they are being enlarged to cope with the business offered. The object of the issue is to pay for the extensions and to provide additional working capital. The nominal capital of the company is £600,000, and that issued (including the present offer) is £410,000. The purchase price has been fixed at £307,400. The profit for the last financial year is put at £57,304, subject to taxation, or over 18 per cent. on the purchase price, and five of the installation companies have not yet completed their first financial year. The company anticipates that the demand for its installations will increase beyond the present large dimensions in consequence of the introduction of higher telephone rates by the Government.

The Brush Electrical Engineering Co., Ltd.—The list is to close to-day in an issue of 339,512 ordinary shares of £1 each at par. The proceeds are required for paying for extensions to buildings and plant, providing additional working capital, and erecting houses for workpeople at Loughborough.

The issue of 7 per cent. seven-year notes by Vickers, Ltd., was fully subscribed.

The recent issue of short-term notes by Fullers United Electric Works was over-subscribed.

Chili Telephone Co., Ltd.—Mr. C. W. Parish presided on 20th inst. at the annual meeting. He referred to the extension progress that had been made during the year of trunk and other lines, new offices, the acquisition of new sites, &c. The new automatic switchboard now being made for Valparaiso would be installed in 1921. They had acquired the business of the Antofagasta Telephone Co., and of the company operating at Calama. Negotiations respecting the renewal of the company's concessions were in progress, and were expected to terminate this year. They could not develop their business unless the Government granted reasonable security of tenure; in view of the increasing cost of plant this was now very vital.

Electro Bleach & By-products, Ltd.—It is announced that Sir Halford J. Mackinder, M.P., chairman of this company, and Mr. E. G. Cubitt have retired from the board, the exchange of shares with Brunner, Mond & Co. having now been carried through.

Marconi Wireless Telegraph Co. of Canada.—Net profit of $102,130 for 1919, increasing the surplus to $395,918, which is carried forward, subject to Government taxation.—*Financial Times.*

Mather & Platt, Ltd.—Interim dividend of 3 per cent., free of tax, on the ordinary shares for the half-year ended June.

Chatham & District Light Railways Co.—Interim dividend of 5 per cent. per annum on the ordinary shares for the half-year.

Chelsea Electricity Supply Co., Ltd.—Interim dividend of 5 per cent. per annum, less tax, on the ordinary shares for the half-year.

Kensington & Knightsbridge Electric Lighting Co., Ltd.—Dividend of 4 per cent. on the ordinary shares for the half-year ended June 30th.

Bournemouth & Poole Electricity Supply Co., Ltd.—Interim dividend on the ordinary shares for the half-year ended June, at the rate of 5 per cent. per annum, less tax.

Lanarkshire Tramways Co.—Interim dividend of 5 per cent. per annum, less tax, for the half-year.

STOCKS AND SHARES.

TUESDAY EVENING.

STOCK EXCHANGE markets are in a somewhat depressed condition. There is nothing much in the situation to induce fresh enterprise, and the talk of cheaper money is stilled. Foreign politics are in too much of a broil to infuse confidence into the Stock Exchange markets, while at home the deplorable chaos in Ireland is an undoubted factor in checking business, though little connection may be apparent at first sight between Stock Exchange securities and Sinn Fein outrages. New issues come along at a rapid rate, and in spite of the public's caution in regard to money, the good stocks are placed without difficulty.

Underwriters of the Calcutta Electric Supply 5 per cent. debenture stock, tax free, issued at 95, were left with 40 per cent. of their obligations, and the price started in the market at 3 discount. It may illustrate the financial fashion of the day if we mention that while the subscription lists were open, orders to buy the stock were sent into the market for execution if the price, when dealings began, fell to the neighbourhood of 2½ discount. This in point of fact is the quotation at which business was done at the start, and considering the security, the stock is cheap at anything like this figure.

Fuller's United issue was taken, we understand, without the underwriters being called upon to pay for any of the stock. Several newcomers have put in an appearance this week. An amount of £250,000 first mortgage 6 per cent., free of income tax, debentures in Bullers, Ltd., has been offered at 100. The security is well covered. The subscriptions were to close on or before Saturday in this week. The Telephone Manufacturing Company offered 100,000 ordinary shares of £1 each at par, the list being due to close on or before August 4th. The company was formed in May this year to acquire the business and assets of a company of the same name, together with those of thirteen allied installation concerns. There ought to be wide scope for a company of this kind, but the shares naturally possess a speculative flavour. Brush Electrical Engineering has issued 339,512 ordinary shares of £1 each at par.

Amongst electricity supply issues, City of London preference have improved to 17s. 6d., and County ordinary receded to 8. Otherwise there is no change in the list. A fair amount of business is being done in Westminster ordinary, and seeing that the shares pay nearly 10 per cent. on the money at the present price, it is not surprising that they are being included amongst investment holdings by people who consider it well to spread their interests over various branches of industry. Edisons in the manufacturing group eased off to 23s. 9d., and there is some little disappointment felt in the absence of any announcement as to the outcome of certain negotiations which were said to be going on a month or two back with other companies. The rumours may have been, of course, market gossip, but they certainly were substantial and explicit. Siemens at 25s. 6d. are a few pence down.

The Kensington Company has declared an interim dividend of 4 per cent. as against 2½ per cent. a year ago. This came as a surprise. So much so, in fact, that the notification was "checked" on the telephone by certain doubters who held the news to be too good to be correct. But the price of the shares is unchanged.

Already foresight is beginning to lay plans with a view to taking advantage of what possibilities may come about by reason of the partial removal of E.P.D. next spring. The Government declining at present to make any material move in the direction of economy, it is argued that other taxes will have to be imposed in one way or another to take the place of any taken off. This contention is weighing with those who look at tax-free securities with particular attention at any period when new taxes may be looming in the distance. The cable group naturally comes to the front in such circumstances, and Eastern ordinary and Globe ordinary are both better this week. It is asked whether the companies can maintain the increased dividends of 10 per cent. on the largely augmented capital recently raised by the Eastern, Eastern Extension, Western and Globe undertakings. The market view is that the companies would not have increased their dividends had the directors not been able to see their way to maintain them on the extra capital now employed, and if the 10 per cent. dividends, free of tax, are continued, certainly the yields now offered look tempting enough. Eastern Extensions and Eastern ordinary both pay roughly 6¼ per cent., on the money, free of tax, equivalent to practically 10 per cent. with tax at 6s. in the £. Going into the matter mathematically, it will be found that the new shares are a little cheaper than the old, though there is not much in it.

Home Railway stocks have fallen sharply, owing to the hopelessness of the position as it stands at present. Though rates may be increased, it is felt that this will stimulate motor competition very considerably, and therefore that Sir Eric Geddes is not justified in looking for such railway receipts as will enable the companies to make good the deficit of 56 million pounds per annum with which they are faced under the existing fares. Metropolitans have dropped 1½ to 20½, although Districts keep steady. The Underground Electric Railway group is fairly firm, owing to the prospect of the omnibus and charabanc part of the business being largely developed and encouraged by the increased railway fares. The £10 shares, however, are lower at 30s., although the shilling variety stiffened to 5s.

There is not much doing in Marconis, the ordinary shares remaining at 3 and the preference at 2⅞. Marconi Marines are 35s., Canadians lower at 9s. Oriental Telephones at 2½ continue their upward advance, and other telephone shares are steady.

The curious anomaly is presented of Anglo-Argentine Tramway first preference, now in receipt of dividends, standing at 3¼, while the second preference are ½ higher. The latter, however, carry arrears of 4½ years' dividends, which in time will probably be paid off, because the Argentine Republic is certainly going ahead financially and industrially, according to the commercial reports which reach this country week by week. Brazilians, on the other hand, are inclined to be dull, though at this juncture prices are swayed more by the financial atmosphere prevailing in Paris than by Brazilian considerations. In Mexicans, the attitude is one of pronounced caution. Everyone is looking for a rise, everything seems ready for a rise, but the guerilla warfare breaks out sporadically, and people are afraid of venturing into Mexicans, although, on the other hand, holders of the stocks decline to sell just as the outlook gives promise of better things.

In the armament group, the new issue recently made by Vickers was taken by the public, and, although the Armstrong 6½ per cent. second debenture stock was partially left in the hands of underwriters, a free market has sprung up in the stock on the basis of 2½ discount below the issue price of 95. Rubber shares are listless, with nothing of consequence doing, though the optimists continue to hammer away at their conviction that the price of raw material is certain to increase in price during the next few months. Of which there is small indication at the present time.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1918.	Dividend 1919.	Price July 27, 1920.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	8	12	6¾	—	£9 8 2
Charing Cross Ordinary	4	7	8½	—	10 0 0
do. do. do 4½ Pref.	4½	4½	2⅞	—	8 8 8
Chelsea	3	4	2⅝	—	8 0 6
City of London	8	10	1⅛	—	8 17 10
do. do. 6 per cent. Pref.	6	6	17/6	+6d.	6 17 2
County of London	7	8	8	— ¼	10 0 0
do do. 6 per cent. Pref.	6	6	8½	—	7 5 5
Kensington Ordinary	6	7	4	—	8 15 0
London Electric	Nil	2½	1½	—	6 0 0
do. do. 6 per cent. Pref.	6	6	8	—	10 0 0
Metropolitan	5	6	2⅞	—	10 8 8
do. 4½ per cent. Pref.	4½	4½	2½	—	8 0 0
St. James' and Pall Mall	10	12	6¾	—	8 16 10
South London	5	6	3⅛	—	9 12 0
South Metropolitan Pref.	7	7	18/9	—	7 0 0
Westminster Ordinary	8	10	5½	—	9 15 2
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	79½	—	7 11 6
do. Def.	33/6	1½	17½	—	8 11 5
Chile Telephone	8	6	6½	—	*4 16 0
Cuba Sub. Ord.	7	7	8½	—	*8 4 8
Eastern Extension	8	10	14¼	—	*8 18 0
Eastern Tel. Ord.	8	10	146½	+1	*8 16 6
Globe Tel. and T. Ord.	8	10	14½	+ ½	*8 15 7
do. do. Pref.	6	6	8½	—	7 1 2
Great Northern Tel.	22	22	214	—	10 4 8
Indo-European	13	10	80	—	8 6 8
Marconi	25	25	3 3/16	—	8 6 8
Oriental Telephone Ord.	10	12	2⅝	+ 1/16	*4 16 0
United R. Plate Tel.	8	8	7	—	*5 14 4
West India and Panama	1/3	Nil	1/16	—	Nil
Western Telegraph	8	10	15	—	*6 13 4
Home Rails.					
Central London Ord. Assented	4	4	44½	—	8 19 9
Metropolitan	1	1½	20½	—1½	6 2 0
do. District	Nil	Nil	16½	—	Nil
Underground Electric Ordinary	Nil	Nil	1½	— ¼	Nil
do. do. "A"	Nil	Nil	5/-	+6d.	Nil
do. do. Income	5	4	56½	—	—
Foreign Trams, &c.					
Anglo-Arg. Trams. First Pref.	Nil	5½	81	— ½	8 9 2
do. do. 2nd Pref.	Nil	Nil	3⅜	—	Nil
do. do. 5 Deb.	5	5	58½	—	8 11 0
Brazil Tractions	Nil	Nil	47½	—	Nil
Bombay Electric Pref.	6	6	18	—	4 10 0
British Columbia Elec. Rly. Pfce.	5	5	86½	—	8 17 0
do. do. Preferrred	2½	5	53½	—	9 7 0
do. do. Deferred	Nil	3	54½	—	5 10 1
do. do. Deb.	4½	4½	65	—	7 14 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	30	—	Nil
do. 6 per cent. Bonds	Nil	Nil	20	—	Nil
Mexican Light Common	Nil	Nil	14	—	Nil
do. Pref.	Nil	Nil	23½	—	Nil
do. 1st Bonds	Nil	Nil	48	—	Nil
Manufacturing Companies.					
Babcock & Wilcox	15	15	93	—	*5 14 4
British Aluminium Ord.	10	10	1 3/16	—	9 8 2
British Insulated Ord.	12½	15	1 3/8	—	8 5 6
Callenders	25	15	1 7/16	—	11 8 6
,, 6½ Pref.	6½	6½	18/-	—	7 4 5
Castner-Kellner	20	17	8	—	5 13 4
Crompton Ord.	10	10	19.6xd	—	10 5 2
Edison-Swan, "A"	10	10	1 5/16	— 3/32	8 8 5
do. do. 5 per cent. Deb.	5	5	78½	—	6 5 9
Electric Construction	10	10	1	—	10 0 0
Gen. Elec. Pref.	6½	6½	18/6	—	7 0 5
do. Ord.	10	10	80/6	—	*6 11 2
Henley	25	15	1¼	—	8 0 0
do. 4½ Pref.	4½	4½	5½	—	6 18 6
India-Rubber	10	10	25/9	—	*7 15 4
Met.-Vickers Pref.	—	8	2 1/16	— 1/16	7 6 2
Siemens Ord.	10	10	25/6	— 6d.	*7 17 0
Telegraph Con.	20	20	20½xd	—	*5 17 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, July 27th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	2/4	6d. dec.
a Ammoniac Sal	per ton	£100	...
a Ammonia, Muriate (large crystal)	,,	£92	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£50	£8 inc.
a Copper Sulphate	,,	£44	£3 dec.
a Potash, Chlorate	per lb.	1/-	...
a ,, Perchlorate	,,	1/3	...
a Shellac	per cwt.	£34	£1 inc.
a Sulphate of Magnesia	per ton	£18	...
a Sulphur, Sublimed Flowers	,,	£28	...
a ,, Lump	,,	£25	...
a Soda, Chlorate	per lb.	6d.	...
a ,, Crystals	per ton	£12	...
a Sodium Bichromate, casks	per lb.	...	...
METALS, &c.			
g Babbitt's Metal Ingots	per ton	£118 to £345	...
c Brass (rolled metal 2" to 12" basis)	per lb.	1/8½	...
c ,, Tubes (solid drawn)	,,	1/6 to 1/6½	...
c ,, Wire, basis	,,	1/3⅜	...
c Copper Tubes (solid drawn)	,,	1/8½	...
g ,, Bars (best selected)	per ton	£164	£3 inc.
g ,, Sheet	,,	£164	£3 inc.
g ,, Rod	,,	£164	£3 inc.
d ,, (Electrolytic) Bars	,,	£114	£4 inc.
d ,, ,, Sheets	,,	£156	...
d ,, ,, Wire Rods	,,	£130	£5 inc.
d ,, ,, H.C. Wire	per lb.	1/4	...
f Ebonite Rod	,,	3/-	...
f ,, Sheet	,,	2/6	...
n German Silver Wire	,,	3/-	...
h Gutta-percha, fine	,,	14/-	...
h India-rubber, Para fine	,,	1/10	1d. dec.
i Iron Pig (Cleveland Warrants)	per ton	Nom.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£59	...
g Lead, English Pig	,,	£38 10s.	£1 inc.
g Mercury	per bot.	£20 10s. to £21	...
e Mica (in original cases) small	per lb.	6d. to 4/6	...
e ,, ,, ,, medium	,,	5/- to 10/-	...
g ,, ,, ,, large	,,	12/6 to 25/- & up	...
g Phosphor Bronze, plain castings	,,	1/6 to 1/11	...
g ,, ,, rolled bars and rods	,,	2/2 to 2/6	...
d ,, ,, rolled strip & sheet	,,	2/3 to 2/9	...
r Silicium Bronze Wire	per lb.	1/11½	...
g Steel, Magnet, in bars	,,	1/8	...
n Tin, Block (English)	per ton	£266 to £267	...
e ,, Wire, Nos. 1 to 16	per lb.	4/9	...
White Anti-friction Metals	per ton	£80 to £335	£10 dec.

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n F. Ormiston & Sons.
r W. F. Dennis & Co.

The Institute of Mine Surveyors.—At a general meeting of the East Glam. Branch at Pontypridd, on July 23rd, under the presidency of Capt. J. W. Walker, M.C., it was gratifying to note the large number present, which indicated the rapid growth of the Surveyors' Institute, and the keen interest taken by all its members. After the usual preliminaries, the President called upon Mr. William Thomas, Principal of the Cambrian Correspondence School, Porth, to read a paper on "The Magnetism of the Earth and its Effect on Iron and Steel," which proved very interesting, and was followed by a discussion. A limited number of typed copies of the paper will be distributed gratis to anyone interested, on receipt of three penny stamps to cover postage.

New Use for Electric Furnaces.—Electric ferro-alloy furnaces have been diverted to a most interesting use commercially, says *Engineering*, quoting *The Iron Age*, of New York. A southern company, which made synthetic pig-iron, ferro-manganese, ferro-silicon, and other similar products during the war in its electric furnaces, found itself after the armistice faced with the problem of discovering a profitable use for its equipment. Prices for ferro-manganese and low-phosphorus pig-iron had declined, and in the production of certain other alloys there was keen competition. The result of wide investigations has been the manufacture in this type of furnace of phosphoric acid and potash on a fairly large scale. For making phosphoric acid, phosphate rock is smelted in the electric furnace, the phosphorus being driven off as phosphoric oxide, suspended in the gases. These are collected and treated by the Cottrell electrical precipitation system, in which the phosphorus compounds are collected electrically as a fine powder. By further treatment and concentration a superior product is obtained, free from any of the impurities which are present when sulphuric acid is the disintegrating agent. In the manufacture of potash, southern shales are similarly treated, with the formation of oxides of potassium in the gases and their electrical precipitation and collection. The substitution of electricity for expensive chemicals in these interesting cases is not only a feature of this new practice, but there is the other novelty that electricity is used both as the destroying or breaking-down agent and as the medium by which the final products are recovered.

INCREASE OF RENT ACT AND BUSINESS PREMISES.

By W. VALENTINE BALL, O.B.E.

Now that the Legislature is definitely committed to the policy of interfering between the landlords and tenants of business premises, it seems to be desirable to say a few words about the recent Act of Parliament by which this interference is effected. It should be observed that what follows is but a brief summary of an Act which abounds in qualifications and provisoes. It is essentially a lawyers' statute.

The term "business premises" is not defined, but it seems (having regard to S. 12 (1) (*d*) of the Act) to include all premises required for "business, trade, professional purposes, or for the public services." It would include, therefore, a shop for the sale of electrical fittings, a factory or workshop, or the office of an electrical engineer. It only applies, however, to such premises where the annual amount of the standard rent or the rateable value does not exceed in London £105; in Scotland £90; and elsewhere, £78.

The Legislature has thought proper to restrict the powers of the landlord in two ways. In the first place, he may not increase rent by more than a certain amount. In the second place, his ordinary right of recovering possession is considerably restricted.

With regard to rent, the Act provides by (S. 1) that where rent has been increased since March 25th, 1920, to more than the standard rent, the increase may not (subject to an exception to be presently mentioned) be recovered. "Standard rent" means the rent at which the premises were let on August 3rd, 1914.

Certain additions may, however, be made to the standard rent. These include:—

(*a*) Six per cent. on the amount of expenditure incurred on improvements or structural alterations since August 4th, 1914.

(*b*) Increased rates payable by the landlord.

(*c*) In addition to the above amounts 35 per cent. of the "net rent."

(*d*) Where the landlord is responsible for the whole of the repairs an amount not exceeding 25 per cent. of the "net rent," or where the landlord is responsible for part of the repairs, such lesser amount as may be agreed, or as may be settled by a county court judge in case of a dispute.

It will thus be seen that even in a case where a landlord has effected no repairs or alterations he may increase the rent of business premises by 25 per cent. So, if under a tenancy expiring on September 30th, 1920, the rent was formerly £100, the landlord might refuse to renew except upon the terms of the tenant paying £135; or he might let to a new tenant at £100. In order to raise rent, however, a landlord must serve a four weeks' notice in a form which is provided by statute. It is to be observed generally that a transfer by a landlord to a tenant of any burden previously borne is to be treated as an alteration of rent.

No premium may be charged in addition to rent.

Coming now to the restrictions which the Act places upon recovery of possession, it may be premised that apart from legislation a landlord has the right to resume possession of premises on the expiration of a lease or tenancy, or, in certain cases, upon breach of covenant by the lessee. The various Rent Restriction Acts passed since 1915 have very much curtailed this right of the landlord, and the Act now under notice affects the landlord of business premises.

It provides that no order or judgment for the recovery of possession of business premises, or for the ejectment of a tenant, shall be made or given unless:—

(*a*) Any rent lawfully due from the tenant has not been paid, or any other obligation of the tenancy so far as the same is consistent with the provisions of the Act has been broken or not performed.

(*b*) The tenant has been guilty of a nuisance, or the condition of the premises has deteriorated owing to acts of waste by, or the neglect or default of, the tenant.

(*c*) *The tenant* has given notice to quit, and in consequence the landlord has contracted to sell or let the premises, or has taken any other steps as a result of which he could be prejudiced if he could not obtain possession.

(*d*) The premises are reasonably required by the landlord for business, trade, or professional purposes, or for the public service, and (except as otherwise provided by this sub-section) the Court is satisfied that alternative accommodation, reasonably equivalent as regards rent and suitability in all respects, is available.

(*e*) (Omitted as not being of special interest), and

(*f*) The landlord became the landlord after service in any of His Majesty's Forces during the war and requires the premises for his personal occupation, and offers the tenant accommodation on reasonable terms in the same premises, such accommodation being considered by the Court as reasonably sufficient in the circumstances, or

(*g*) The premises are required for occupation as a residence by a former tenant thereof who gave up occupation in consequence of his service in any of His Majesty's Forces during the war.

(*h*) The premises are *bona-fide* required for the purpose of a scheme of reconstruction or improvement which appears to the Court to be desirable in the public interest.

The existence of alternative accommodation is not, however, to be made a condition where (*inter alia*) the landlord gave up the occupation of the premises in consequence of his service in any of His Majesty's Forces during the war, or where, in the opinion of the Court, greater hardship would be caused by refusing an order for possession than by granting it. This latter proviso only applies to cases in which the landlord became such before September 30th, 1917, March 5th, 1919, or May 20th, 1920—the date applicable depending upon the Rent Restriction Act which was then in force.

The task of those who have to interpret this complicated enactment is certainly not enviable. It may be assumed that no tenant who is anxious to retain possession will allow his rent to fall into arrears, or commit any breach of his contractual obligation. But what meaning is to be attached to the phrase "accommodation reasonably equivalent as regards rent and suitability in all respects"? In the case of a factory or workshop, will it suffice to offer similar premises in another district?

Again, suppose the tenant has sub-let, and there is no restriction against sub-letting, may he go on paying £x in rent while he is making £$x+y$ out of his occupation? It is a curious fact that although an Act passed on December 23rd, 1919, placed some restriction upon sub-letting, the new Act which repeals it does not do so.

It is material to notice that although in its general application the Act is to remain in force until June 24th, 1923, as applied to business premises it expires on June 24th, 1921.

*MAINTENANCE INSULATION TESTS ON ELECTRIC CABLES.

By L. R. Lee.

It is fairly certain that most engineers engaged in the maintenance of large cable networks will agree that even under existing circumstances time spent on the systematic and periodical testing of the principal cables attached to a network is time well spent, and is, in fact, an insurance against serious breakdown, and that they who do not carry out such tests are to a certain extent living in anything but a paradise. It may be thought at first sight that the periodic insulation testing of lead-sheathed paper-insulated cables unless carried out very frequently indeed would not result in saving breakdown, but it can be stated without hesitation that on a modern and well-impregnated paper cable, a fault due to puncture of the lead sheath and the consequent ingress of soil water takes two or three months to mature, so that insulation tests taken, say, once every four weeks, are quite sufficient to save a bad burn out.

Having, however, decided that the testing is well worth the doing, one is up against the fact that in an industrial area it is almost impossible to get a cable down to permit of the testing, as usually carried out, viz., from the conductors to earth or lead sheath, unless the work be done either at night or on a Sunday. There are even many cases where, unless the consumer is supplied on a ring main, his supply cable cannot be switched out at all for months at a time.

A method, therefore, of assuring oneself of the integrity of the lead sheath of a cable, and the consequent well-being of the insulation, is required, which can be applied at any moment, the cable being either "alive" or "dead." It is claimed by the writer that he has succeeded in devising such a method, which is automatic in its action, and is not dependent on (1) the use of a test battery; (2) the cleanliness of terminals, to which the cable is attached; (3) the accessories attached to the cable being investigated (such, for instance, as current transformers), and/or (4) the temperature of the cable. To some extent the testing of a cable can be carried out by the incorporation in the cable of a conductor now known as a "test sheath" or insulated "B.O.T. earth shield," but supposing that the cable whilst being laid, or at any other time, had become so bruised mechanically that the insulation between the test sheath and lead sheath of the cable was ruptured, and consequently the lead sheath in actual contact with the test sheath conductor, then an attempted insulation test on the test sheath would give a "dead earth," although the cable would probably be as good as ever under working conditions. It is not suggested, however, that a cable should be left in this condition. Again, with regard to (4) above, the basic insulation figure of the ordinary test sheath conductor is necessarily of very low order, and with many miles of cable in series, and the cable warmed up by use, such figure becomes so low as to be unreliable as an indicator of the integrity of the lead sheath.

With the new device mentioned above, which consists of a conductor composed of wires or strips concentric with the cable, and having alternate wires or strips composed of dissimilar metals, such, for instance, as zinc and copper, or any suitable two metals well separated in the potential series, each being lightly insulated and the whole again lightly insulated from the lead sheath, no attempt is made to take an insulation test in the usual way, as when the lead sheath of the cable is broken or pierced, soil water obtains an ingress to the bi-metal conductor, and a primary battery is the result, so that on applying an indicating instrument to either end of the conductor and across the two metals a deflection is obtained. Thus, as above, even if the insulation between the bi-metal conductor and the lead sheath become broken and the two actually in contact, no reading is obtained until an electrolyte is present. Assuming in this case that owing to short circuit the strips actually damaged gave no reading even with the presence of soil water, then one would have several other undamaged strips to fall back upon for the purpose of obtaining readings—hence the necessity of keeping the strips separately insulated throughout. There is, in fact, no deflection obtainable from any other cause than that of water chemically impure having obtained access to the bi-metal conductor.

Indications are therefore of a very reliable character, and having obtained a deflection it can be definitely decided that water has obtained ingress, and that the cable needs repair, for which unhurried preparations may be made.

It can also be claimed that so much in the way of spare cables need not be provided, or the tendency would be that way, and certainly on new cables all overtime requisite for testing under present conditions would be abolished. Unfortunately, existing cables cannot be treated in like manner. Results which have been obtained on a sample length of cable, made with the concentric conductor composed of alternate strips of zinc and copper, are as follows:—

The lead sheath of the cable was punctured by a hole 1 mm. in diameter, and the portion placed in a tank containing drinking water from a well.

Immersion		Deflection Cu—Zn	
0 hours.	...	0	The instrument used was a Paul's Unipivot galvanometer calibrated 1° deflection = 5 micro-amps.
53	...	4·7	
72	...	5·5	
119	...	10·5	
145	...	11·4	
215	...	12·7	
265	...	17·0	
529	...	23·0	

As the water used in the test was apparently fairly pure, it is safe to assume that ordinary soil water would give larger or earlier deflections.

It will be seen that the device is equally useful when applied to all classes of cables, whether metallic or non-metallic sheathed.

It may be used with advantage on all E.H.T. and L.T. power cables, on underground telephone and telegraph, and deep-sea cables.

In practice on power networks the dissimilar metals forming the auto conductor would be attached by leads to a terminal board at some convenient place in the generating or sub-station, and the switchboard attendant would make observations as many times a day as thought to be necessary. On those networks, therefore, where an insulated test conductor is normally used in any case on cables, the actual testing of the cables can be carried out systematically, with reliability, and at no cost, provided the conductor described above is substituted.

It is perhaps hardly necessary to add that the dissimilar metals are kept apart right throughout the entire length of the cable, being bird-caged over the conductor joints at each cable joint.

Application for patent rights has been made.

Cape Town Dispute.—Our correspondent writes:—"The dispute in the electrical trade has been settled by the Joint Board of the Building Trades, in conjunction with the claims of the carpenters bricklayers, masons, plumbers, and painters. The basis of the settlement is a flat rate for all these trades of 3s. 6d. per hour - the carpenters, bricklayers and masons receive this amount at once, but the other trades have to be brought up to the amount in 18 months by three instalments. The present wages for electricians will be 2s. 11d. per hour for competent men, with a minimum of 2s. per hour for other men above the apprenticeship stage. These rates are based on the present cost of living, and the workmen get a corresponding increase in case of any further increases in the cost of living, but no reductions are to be made for 18 months, and after that period only after three months' notice. A feature of the settlement is the provision of a holiday fund—2d. per hour is deducted from each man's wages and paid into a bank to his credit each month. This money is to be paid out to the men before Christmas each year, and the men are to have a fortnight's holiday, except for indispensable work. The working hours are to be 44 per week."

LEAVES FROM AN INSPECTOR'S NOTEBOOK.

By "ANODE."

In all cases where you make an examination of plant you have to give the insulation resistance of each machine, or a valid reason for not doing so. This necessitates a Megger, and the Megger question is one which makes an insurance inspector in a large district sit up and say things about Messers. Evershed's that in ordinary circumstances he would never dream of saying. A Megger grows in weight when it is carried any distance, and after a mile I guarantee it will weigh anything from 150 to 500 lb. according to temperature.

I found the best way to get over the difficulty was to persuade my clients to buy a Megger for their own use, so that they could take the pulse of each machine once a week and get out statistics, and also that a Megger could greatly help them in diagnosing faults. (I must have sold quite a lot of Meggers in this way, but did not have the foresight to take up an agency for them.)

A tip about using a Megger. When connecting up to make a test, always make the earth connection first, then touch the commutator with the end of the other lead; if the "juice" is on, the needle of the Megger will jump. This has saved me many a shock. I have often noticed how clumsily some people take a reading with a Megger. They connect up the leads, take off their waistcoats, and set about the Megger like unto a coffee mill and grind away for five minutes. Nothing is more futile, and, let it be whispered, dangerous. The proper way to handle a Megger is to turn *very slowly* for a couple of revolutions, this will bring the needle to *nearly* its correct position, then increase the speed in the next couple of revolutions, and you get your reading, while turning for ever so long will not alter it. To give a Megger to some so-called electricians is asking for trouble, especially if it is an old 220-volt installation and a 500-volt Megger.

I remember on one occasion inspecting a breakdown in a repair works; the trouble was an earth on a small D.C. armature. Nothing was apparently wrong with the coils, and I suspected the trouble was at the back of the commutator. I asked that current be applied to the job, so that we could see by the sparking, or smoking, exactly where the trouble was. It so happened that at the time the current was off, and to my astonishment the foreman asked for the shop Megger. He put this on to the job, and, after a few seconds' vigorous turning, sufficient smoke came from the back of the commutator to indicate the exact place of breakdown.

On another occasion I was sent out to a colliery to examine a main cable which, I was informed, had a dead earth on it. It was new, and had not up till then been in use. Before starting up, the electrician tested it with a home-made testing set, made out of a telephone magneto and bell. He found that the bell rang, so decided to leave the job for me. On testing the cable I got a reading of 100 megohms from my Megger. What had happened was that the cable acted as a condenser, the action of which was as a sealed book to my worthy friend.

There is a tremendous difference in the way in which an inspector's reports are treated; in some instances the reports never get further than the office, in which case their value is exactly nil, while if the reports go out, as they should, to the electrical engineer, they are a very valuable aid to him in keeping an eye on his plant, and if they are tabulated the data are of inestimable value.

In one case, at a large colliery, the engineer asked me to give, in addition to the name particulars of the machine, the situation of the machine, and the work it was doing. This enabled him immediately to locate the machines, and have any defects or suggestions attended to immediately. We found that at the end of three years the number of breakdowns and stoppages was reduced to almost nil; in fact, so satisfactory were the results obtained, that the company decided to discontinue the insurance, but retain the inspection only.

An inspector, if he uses tact, can save his company a lot of money in the course of a twelve-month, and himself a lot of trouble in making his inspections. Some inspectors adopt a high and mighty attitude, and get the engineer's back up, with the result that the rough places are not made smooth for him.

One firm with a large installation insured its plant, and I had to make the examination. On the occasion of my first visit I was treated very cavalierly by the engineer, who seemed to think that I was there to spy out the land and report any shortcomings on his part. He refused to stop any machines for me, and told me that my inspections could only be made in the dinner hour, and, further, that I could have no assistance. After remonstrating with him, he very unwillingly allowed one of his fitters to accompany me on my inspection. After making the inspection I reported the result to him, and got him to look at several things I did not like. I took the opportunity of pointing out that my investigations were likely to be of great use to him in keeping his plant up to an efficient standard, and incidentally helping his output. This put the matter in a different light, with the result that on any future visits the works generally were at my disposal.

When my successor visited these works he made a lengthy report on the machines, calling attention to the dust in them, but saying nothing about the condition of the bearings, brushes, starting appliances, fuses, &c., making it appear that the machines were neglected. As if you could eliminate dust in a dusty works! On his next visit his pathway was not strewn with roses, and he had a very thin time.

ELECTRICITY SUPPLY DISTRICTS.

The East Midlands Scheme.

An exhaustive inquiry, before the Electricity Commissioners, Sir John Snell (presiding), Sir Harry Haward, and Mr. H. Booth, was opened at Nottingham on July 21st, and continued on the following day, relative to the Corporation's application for leave to borrow £868,000 to carry out the first portion of a scheme, the whole of which is estimated to cost ultimately £1,009,000, for extending the electricity supply in the city and district by the erection of a new generating station, for which land has been acquired contiguous to the river Trent at Clifton and near the Clifton colliery, which is one of the largest mining undertakings in the immediate vicinity of the municipal area. The application was contested by the Derby and Notts. Power Co., which already possesses statutory powers in relation to the district, and offered to supply the municipality with the necessary energy from a new generating station to be provided at Colwick, which is on the other side of the city, and also close to the Trent. The proceedings were notable for the support accorded to the company's project by Mr. A. R. Atkey, one of Nottingham's parliamentary representatives, and himself a member of the Corporation, who adopted the view that any alternative scheme which would enable the city to avoid so huge a capital expenditure should be carefully considered. The inquiry, therefore, resolved itself into a consideration of the privileges of public *v.* private enterprise, the Corporation contending that the company's application represented an interference with the rights of municipal supply. The plant which the Council suggested should be installed in the first instance would consist of 20,000 KW., estimated to cost, with land, buildings, machinery, &c., £752,000, or £37.63 per KW., and the first and second sections for 40,000 KW. installed £1,009,000, or £25.225 per KW. The project is to form part of the general East Midlands scheme under which Leicester, Nottingham, and Derby may be linked up by an extension of trunk mains, Leicester also building a new power station and Derby extending its present arrangements.

The case for the Nottingham Corporation was conducted by the town clerk (Mr. W. J. Board), whilst Messrs. Macmorran, K.C., and Maconachie appeared for the company, Mr. Craig Henderson representing coalowners and ironmasters of the district. Mr. Macmorran explained that the company had powers to provide electricity for the whole of Notts. and part of Derbyshire, including Derby, Chesterfield, Long Eaton, Mansfield, and Nottingham, but in those boroughs it could not exercise its powers without the consent of the Corporations concerned. The company had an authorised capital of £1,800,000 in £1 shares, and it was already supplying elec-

tricity in Ilkeston, Heanor, Ripley, Sandiacre, Sawley, Beeston, Eastwood, Chilwell, Stapleford, Kimberley, Nuttall, Gossall, and Annesley, and it had laid cables and was prepared to supply two other districts, Belper and Heage. The units supplied in 1912 were 1,839,899, and for the current year they were estimated at 10 millions. The proposal was to provide a central supply for all purposes from the new works to be erected at Colwick, so as to permit of the other plant being closed down. The company would be in a position to supply energy in bulk to all of them, including Nottingham. It could do so on reasonable terms, and within a shorter time than could be done by any of the public undertakings. There was another large power company in the south formed for the county of Leicester. If the Notts. & Derby Co. succeeded in its application it would be possible, as the two companies were practically under one management, to link up in such a way that there would be an enormous saving to both companies, and this would be very much to the advantage of the public. He contended that the generating station which Nottingham sought to set up was entirely unnecessary, as the company could supply the city with all the electricity required.

Mr. Alfred Holland, chairman of the company, stated that since 1913 they had spent £190,500 in that area. They had always had in view the erection of a power station at Colwick, and would have built it before this but for the war. The Midland Coal Products Co., he explained, in reply to questions by the town clerk, had selected a site at Colwick adjacent to the proposed generating station largely because they anticipated being able to dispose of their waste heat and gas to the Derbyshire and Notts. Power Co. The gross estimated revenue of the latter company for this year was £63,000, and there would be a surplus of £17,000.

Mr. H. L. Williams, engineer for Messrs. Balfour, Beatty and Co., estimated the cost of the company's proposed station at £840,000.

Evidence was afterwards given by Mr. J. S. Highfield, vice-president of the Institution of Electrical Engineers, who did not see how Nottingham could ever require a 240,000-KW. station, its supply to-day being 12,000 KW. only; by Mr. Arthur Green, general manager and secretary of the Midland Coal Products Co., Ltd., and by Mr. A. R. Atkey, M.P.

On the following day Mr. Macmorran, for the company, stated with regard to the proposed terms of supply to Nottingham, that for a load not exceeding 6,000 KW. the maximum price, with coal at 20s. per ton, would be £6 per annum, plus 0.45d. per unit extra high tension, delivered in Nottingham.

Mr. G. Balfour, M.P., chairman of the parent company, said that the £6 was the maximum. The most modern generating practices would be adopted. He would be willing to agree with the engineers of the Nottingham Corporation as to coal consumption, and would be bound to reduce the maximum according to an agreed scale of coal consumption.

Mr. J. H. Rider, who had prepared the Corporation's scheme, expressed the view that the company's proposed station had not been designed by people with experience in such work.

Ald. E. Huntsman, chairman of the Corporation Electricity Committee, emphasised the consideration that the scheme which they had proposed was in the best interests of the city. Replying to Mr. Macmorran, he said that there was a deficiency of £8,000 on the city electricity undertaking in 1919. He admitted that during the last few years they had been unable to supply the needs of some important consumers. He denied that there had been any narrow shutting out of offers upon the part of others to supply the necessary energy because of a preference for a municipal supply.

Mr. C. Henderson, for the Notts. & Derbyshire colliery owners, suggested that the result of a recent conference between that body and the Corporation and other authorities was that the coal owners did not propose to take electricity if it became a Nottingham Corporation scheme solely.

Ald. Huntsman said that he did not gather that, but no doubt if it became a joint authority the colliery owners would come in. If it were confined to Nottingham, they would not offer electricity to the colliery owners.

Mr. Rider explained that the Nottingham station as proposed was not a scheme for the East Midlands, but for Nottingham alone. It was so planned, however, that it could be added to, section by section, so as to fit it for the needs of the larger area, thus making it a super-power station. If consent was given to the Corporation's application, work could be started on the new station in a fortnight.

Mr. C. H. WORDINGHAM gave evidence, pointing out that, if the Nottingham Corporation scheme were not sanctioned, it would completely upset the whole project for an electricity undertaking for the East Midlands area.

The TOWN CLERK OF NOTTINGHAM, in summing up the Corporation's case, suggested that the company making the rival application had been more prolific of legislation than generating stations. The company had possessed powers with regard to this large area since 1901, but up to the present time had exercised them to a very limited extent only. The position of both applications, with respect to a future joint authority, had to be considered.

Mr. MACMORRAN, for the company, pointed out that since 1912, £190,000 had been spent, and the total expenditure to date had been £350,000. That, he observed, did not look as if it was a paper company. They were prepared to go on with the developments in 1912 and 1913, but they were held up by the war, and after the war the Act of 1919 came into force. The company was only now in a position to carry out the obligations undertaken by it in 1901. The Corporation's application had been made a stalking horse to commit the Commissioners to some action as regarded a joint scheme. If it were only an application for the City of Nottingham he would not be there to oppose it, but it was being made a colourable excuse for something else. Sanction for its application was absolutely necessary if the company was to carry on its undertaking in the way in which it was constituted by Act of Parliament.

The inquiry terminated after lasting two days, and the Commissioners, who visited the sites of the projected generating stations during their stay in Nottingham, will report in due course.

THE NATIONAL PHYSICAL LABORATORY.

(*Concluded from page* 106.)

CONTINUING our review of recent work done at the Laboratory as set out in the annual report and with particular reference to electrical work, it may be mentioned that in addition to special war work, much work of a more routine character was carried out, especially as regards instruments for the Admiralty and for power plant and munition factories. The growth of the Navy threw a heavy strain on the electrotechnics department, as all switchboards and other electrical instruments and materials for the Navy are tested at Teddington.

Fundamental Units.—The present fitness of the Ayrton-Jones balance for the measurement of current in absolute measure is doubtful, and some renewals are to be made. Satisfactory results have been obtained in the use of the balance to measure the mean value of a slightly varying current. The precision of measurements in terms of International units of current, resistance and E.M.F. is not at present so good as before the war.

General Electrical Measurements.—In 1918, a new method for the measurement of the velocities of projectiles was devised, and experiments have been made to determine the utility of the method and to obtain information which might lead to considerable use of the apparatus. In the latest form of the apparatus a shell is caused to pass through several large coils of insulated wire in series and in circuit with the primary of a transformer, the secondary of which is in circuit with one string of an Einthoven galvanometer. When a projectile passes through the coils a current, or change of current, is induced in the circuit, and this results in a momentary deflection of the galvanometer string. The photograph of the deflection as obtained on a fast-running kinematograph paper is in a form approximating to that of a complete sine wave. Such traces, when associated with a time trace, which will be referred to later, enable the time of passage of a projectile through two coils 10 or more feet apart, to be determined with an error not greater than one fifty-thousandth of a second. In addition, by placing a coil on the muzzle of the gun, the time at which the base of the shell leaves the gun can be determined with an error not appreciably greater than that already stated. The results are regarded as very valuable. The timing arrangement used consists of an electrically-driven fork having a frequency of 1,000 per second, electrically-maintained by a triode valve by the method of Prof. Eccles and Mr. Jordan, except that the magnet used is a magneto magnet and the anode and grid circuits are approximately tuned. A secondary coil is coupled to the anode inductance coil and placed in circuit, through a resistance, with one string of the Einthoven galvanometer tuned approximately to the frequency of the fork. The vibration of the string is recorded on the photographs as a sine curve. At present, the photographs are taken on bromide kinematograph paper, the paper travelling at about 3½ metres per second, but this speed it is hoped to increase very considerably.

Advance has been made in the calculation of effective resistances at wireless frequencies, and the measurement of such resistances, using the very steady undamped oscillations provided by triode valves. The problem of the measurement of effective inductance of four terminal standards of resistance is being attacked, and very satisfactory results have been obtained. Comparison of standards of radio-frequency has been commenced, with very encouraging results.

Investigations have also been made with regard to improvements in compass magnets and the most suitable temperature of quenching. The magnetic properties of bars having various proportions of carbon and tungsten have been determined, and some experiments have been made on the rate of decay of the moment of magnets which were magnetised immediately after quenching. Some measurements on the hysteresis loops of magnet steels at various temperatures have been made, which show that remanence increases and coercive field diminishes with rise of temperature. These results indicate that the temperature coefficient of bar magnets can be made negative, positive, or zero by altering the ratio of length to diameter.

Electrotechnics.—The economy of turbine-generators is tested by the amount of steam used per unit of electrical energy generated. A large number of instruments used in such tests are received for calibration, and the engineers of some of the largest generating

plant make a practice of sending their reference instruments to the laboratory from time to time. The experience of several years of the accuracy obtained from instruments used for important tests shows that there is often much to be desired in their performance, the chief errors being commonly due to the properties of the series transformers employed. Experimental revolution counters of an electromagnetic type are in hand for the Air Ministry.

Experiments are being made, in conjunction with the Osram-Robertson Research Laboratory, to adapt the gas filled lamp for instruments whose indications are read by the reflection of light from a mirror, and they promise to afford a satisfactory solution of the problem.

A research on oils used in transformers was undertaken with the assistance of the Ministry of Munitions in 1918-1919. Owing to the war conditions prevailing, it was only possible to carry out a portion of the programme intended.

Owing to the delay in delivery of a motor-generator set, it has not been possible to complete the research dealing with buried cables. The values obtained for the temperature rise in cables laid in different ways seem to indicate that cables drawn into ducts become the most heated, armoured cables laid direct are the coolest, whilst solid-laid cables occupy an intermediate position. But an examination of the cables used in the tests showed that whereas the thermal resistivities of the cables laid solid and in the duct were of the same order, about 1,040 thermal units, that of the armoured cables was considerably lower, about 667 thermal units. This difference between the thermal constants represents a difference of about 20 per cent. in the current required to produce a given temperature rise, and when corrected for, brings the results with the armoured cables and those laid solid in bitumen much closer together.

For practical purposes, a cable may be assumed to have reached its maximum temperature when it has attained 98 per cent. of its full temperature rise; this occurs after 20 hours in the case of a cable in a duct, after 70 hours in a cable laid solid in bitumen, and after about 80 hours in an armoured cable.

In order to ascertain the maximum temperature to which cables can be subjected for long periods without damage to the dielectric, the materials used in insulating cables are being examined separately so far as samples can be obtained from the makers.

The difficulties experienced by instrument makers in obtaining satisfactory supplies of special resistance alloys, and, more particularly, manganin, led to the investigation of these materials. Difficulties experienced are want of constancy and a large temperature coefficient of resistance. It was found to be impossible to fix the reason for the large differences, and as an attempt to trace these troubles from the source, some manganin alloy was made in the metallurgical department of the laboratory and rolled into rods. These rods, when tested, had a temperature coefficient of resistance as small as that of the very best material hitherto obtained from Germany. Subsequent drawing, however, showed that the annealing between some of the drawing processes was largely or entirely responsible for the change in the coefficient. Further bars were, therefore, supplied to be drawn down as far as possible without annealing. The samples were then tested for temperature coefficient, annealed and re-tested. In this way wire has been produced down to the very finest sizes, in all cases having a very small temperature coefficient. Further work has resulted in one maker drawing all sizes of wire down to 0·07 mm. without intermediate annealing.

Several new types of insulating materials have been tested during the past year, both for Government departments and private firms, and in addition, the research on composite insulating materials, organised by the Research Committee of the Institution of Electrical Engineers, has been put in hand.

The special requirements of the Air Ministry for light weight accumulators having a high capacity have resulted in a number of tests being made on the various types. Tests made to determine the capacity at temperatures down to − 20° C., were uncertain to within ± 10 per cent. owing to the inconsistency of the accumulators, but, broadly, the capacity decreased by 50 per cent. when the accumulator was maintained at a temperature of − 20° C.

Heat Division.—In the physics department a line of investigation now in hand is the development of instruments for the determination of the humidity of air in cold stores. One of the two methods submitted is an electrical one depending on the sudden evolution of heat from dry cotton when exposed to a moist atmosphere.

Radium and X-Ray Work.—The number of samples of radium of high content tested during the year was 88, containing altogether about 6,175 milligrammes of radium bromide of the approximate value of £80,000.

The radium tests have hitherto mainly been carried out with a combined gold leaf electroscope and an ionisation chamber. A second method, due to Rutherford and Chadwick, has been developed and put into use this year, several improvements being effected in the method of manipulation. It is a "null" method in which the ionisation produced by the radium under test is balanced against the ionisation produced in a standard chamber; the balance is detected by means of an electrometer. The results obtained by this method agree with those obtained by the direct method of comparison to well within ± 1 per cent.

Measurement of the absorptive qualities of materials used for protective purposes in radiography had to be abandoned owing to pressure of other work in connection with the war. Preparation is now being made to proceed with the investigation. Recent investigations on the diffraction of X-rays by crystals have shown that X-rays are of the same nature as light waves, but have a much shorter wave-length than light waves. It is proposed to find the absorption of the material under test for definite wave-lengths chosen from different parts of the X-ray spectrum, and covering the whole range of wave-lengths likely to be met with in ordinary practice.

With regard to the examination of materials by X-rays, a number of specimens of clay pots have been examined radiographically. Minute air-holes, specks of heavy material such as iron oxide, and bits of plaster from the mould embedded in the clay were readily detected. After firing the pot, the iron oxide fused with the clay in its immediate vicinity, leaving a cavity in the centre. Further, examination of the green pots for air-holes was carried out with the fluorescent screen; this method proved effective and rapid for detecting air-holes. Radiographs taken of magneto distributors known to be faulty, show that the faults can readily be detected by this method.

A large number of experiments were made and new devices invented for war purposes; some of these cannot be reported upon, but a brief *resumé* of many of them, details of some of which have already been published, are given in the report.

THE BIRMINGHAM HEALTH EXHIBITION.

(BY OUR BIRMINGHAM CORRESPONDENT.)

THE most popular feature in connection with the Royal Sanitary Institute Congress at Birmingham is the Health Exhibition of Appliances for Housing and General Sanitation and matters relating to health and physical welfare, at Bingley Hall. It was formally opened on July 19th by the Lord Mayor of Birmingham (Ald. W. A. Cadbury), with whom was Viscount Astor, President of the Congress, and it will remain open until August 5th. The great hall is filled with an immense variety of things of hygienic and home interest, and, naturally, electrical appliances occupy a very prominent place in the exhibition.

The silver medals of the Institute were awarded to the CITY OF BIRMINGHAM ELECTRIC SUPPLY DEPARTMENT for a large and comprehensive stand of electrical equipment, to which a number of the leading firms contributed; and to the HOOVER SUCTION SWEEPER CO., LTD., for the electric suction sweeper. Bronze medals were given to MESSRS. CHARLES E. BECK & CO. for their "Thor" electric washing machine; to the "GEM" LABOUR-SAVING DEVICE CO., Manchester, for the Gem electric vacuum cleaner; and to the WESTERN ELECTRIC CO., LTD., for an electric sewing machine.

The display of the BIRMINGHAM ELECTRIC SUPPLY DEPARTMENT is contributed to by eight well-known houses, each a specialist in its own particular line, so that variety, and high quality, are assured. CALLENDER'S CABLE & CONSTRUCTION CO., LTD., devotes a considerable amount of space to a collection of Kalanite insulating material, which is in a wide range of forms, and is said to be taking the place of ebonite and porcelain. It is heat resisting and acid proof, and the samples shown have been tested to 20,000 volts. The claims of the Kaleeco wiring system are also emphasised, and there is, as might be expected, a comprehensive display of rubber wires and cables.

On the section devoted to the products of the GENERAL ELECTRIC CO., LTD., prominence is given to the new "Connor Magneto," and popular attention is directed to a pedestal heater which is easy to use, and is very effective in small outside buildings. This pedestal, which takes 100 watts, will boil a pint of water in ten minutes, and toast bread in less than half that time. The effective application of the immersed heater is demonstrated in sterilisers, in handy form, for use in hospital theatres, and towel heaters.

The Creda electric still is an interesting feature in the exhibit of CREDENDA CONDUITS, LTD. This apparatus, which will supply distilled water at the rate of four pints per hour, is used largely in dispensaries, laboratories, and the like, and sterilisers, of various types, are exhibited.

On the METROPOLITAN-VICKERS ELECTRICAL MANUFACTURING CO.'s section the Cosmos lamp, and the new helium lamp are conspicuous. The latter, for half-watt lamp lighting, gives a diffused light, and is dust proof; a great advantage is that it can be arranged for any half-watt lamp up to 2,000 C.P. A lot of artistic lighting fittings, and electric ventilation fans, also have an interest to those anxious to give practical application to hygienic principles.

MESSRS. BERRY'S ELECTRIC, LTD., show their Magicoal electric fire; its great claim is cleanliness and economy of work. The fire is complete for four heat control with a maximum of three KW.

PREMIER ELECTRIC HEATERS, LTD., show a collection of heaters, stoves, &c.; the BRITISH THOMSON-HOUSTON CO. exhibits a variety of products for which the firm is well known; and DAVID SHANKS & CO., LTD., displays bowls, in opal and alabaster, as well as lamp standards and fittings.

Many different types of electric vacuum cleaner are to be seen. TURNER ASPIRATORS, LTD., display the "Little Briton," a box-type machine, power being supplied to the motor at 210 volts. On the stand of CHARLES E. BECK the "Thor" cleaner, with its horizontal motor, receives popular notice, but chief interest here lies perhaps in the "Thor" electric washing machine, the merit of which has been recognised by the granting of an Institute award.

The electric sewing machine on the stand of the WESTERN ELECTRIC CO., finds many interested visitors, particularly

ladies, and the ease with which garments were made, without pedalling, impressed many. Vacuum cleaners, soldering irons, fans, and intercommunicating telephones are displayed.

Messrs. Napier-Kimber, Ltd., give prominence to the Canadian electric vacuum cleaner. Its powerful suction was demonstrated, this being explained to be due to a special design of the six blade steel fan and efficient motor. Here, as on many other stands, due attention is given to the claims of the electric kettle.

Beatty Bros., Ltd., show their "Time Saver" electric washing machine, which has advantages in simplicity of construction, and is easy in manipulation, mischief to clothes being negligible.

Working demonstrations of the Hoover electric suction sweeper are given to show its distinctive character. The main feature is that this appliance is so constructed that the air suction slightly lifts the carpet from the floor and beats it upon a cushion of air. Electrical equipment is an important feature in the working of the various appliances of Ozonair, Ltd., and in an exhibition of this kind, considerable attention is directed to the Ozonair system of ventilation, and to apparatus for laboratory and research work, and for the purification and sterilisation of water by ozone. Magic Appliances, Ltd., show an effective blower for use in factories. J. & M. Steingold demonstrate the important part which electricity plays in floor planing; and the Gem Labour-saving Device Co., is responsible for an attractive display of cleaners and washers. It has the distinction of securing two bronze medals—one for a hand vacuum cleaner for use with two hands, and the other for the Gem electric vacuum cleaner, which is suitable for various voltages and may be applied to many uses.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Electrical Cooking and Heating Devices.

Any improvement in electrical cooking apparatus is an important step, as it is generally felt that this application of electricity is destined to have a great future. Among the latest advances in this direction is an electric oven produced by the Arora Co., of Loughborough, whose business has rapidly expanded, necessitating new works to deal with the great amount of business coming to the firm. This oven (fig. 1) contains eight distinct elements with a switching arrangement designed to give varying amounts of heat. Four of these elements are mounted in the top of the oven, and two are fixed on each side. The four top heating elements have a separate controlling switch which permits three degrees of heat. At "high" all four bars glow at full red heat in 10 seconds, consuming about 2 units per hour. The "medium" position switches on two bars only, and at "low" all four bars glow at a quarter heat. The side elements are controlled by an identically similar switch. Very economical operation is claimed for this oven, and it is said that cooking for a small family can be done in 1½ hours with the consumption of about 3½ units. As will be seen from the illustration, this cooker is very similar in appearance to the usual type of gas oven. The electric "fire" shown in fig. 2 is highly finished in polished brass, and is meeting with a great demand. Fig. 4 illustrates a new ship heater by the same firm. The usual type has a 500-watt loading, but heaters for use in large cabins possess two 500-watt elements controlled by separate switches. The terminals are protected by a specially designed box to enable lead-covered cable to be easily jointed. These heaters are finished in matt black or white enamel.

Fig. 1.—"Arora" Electric Oven.

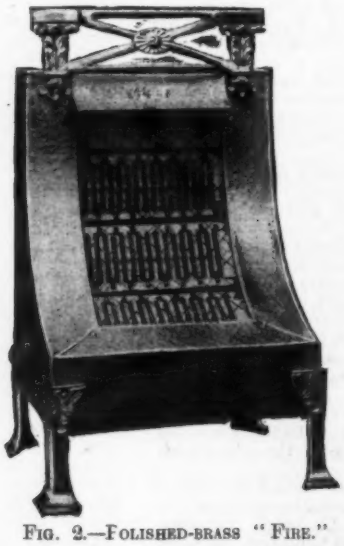


Fig. 2.—Polished-brass "Fire."

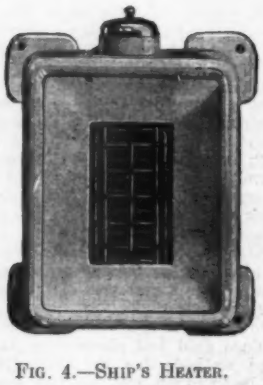


Fig. 4.—Ship's Heater.

A B.T.H. Dental X-Ray Tube.

Modern dentistry owes a great deal to the science of radiology, and especially to the Coolidge X-ray tube. For dental work the radiator dental type of Coolidge tube (fig. 3) has been developed, and is intended for use only with specially designed apparatus. In the dental tube, by far the greater part of the heat imparted to the target is conducted to the copper radiator, instead of being radiated through the glass wall of the bulb as in the ordinary universal type Coolidge tube. It is, therefore, possible to make the bulb of the dental tube quite small—3½ in. in diameter. In addition, the tube is self-rectifying within the limits of its allowable energy output, and can be used directly across the terminals of an induction coil or transformer without any auxiliary rectifying device. The cathode arm extends 2 in. from the bulb at right angles to the anode arm, which measures 9 in. from the

Fig. 3.—B.T.H. Dental X-ray Tube.

bulb to the end of the radiator, and the rays are emitted from the tube in a line with the axis of the anode, thus facilitating the manipulation of the tube. The cathode circuit is earthed, so that there is only one high-tension wire, and this is always connected to the part of the tube farthest from the subject. It is thus possible to employ a minimum distance between film and focal spot, enabling the operator to obtain satisfactory radiographs of the teeth and jaws with comparatively short exposures. The tube is designed for an energy input not exceeding that corresponding to a current of 10 milliamperes, at a "useful" voltage equivalent to a 3-in. parallel spark gap between points. As this tube is designed to operate only in connection with special machines, and always at a fixed voltage and current, the procedure is limited to closing the switch for the length of time necessary to produce on the photographic film the effect desired by the operator. The time factor is the only variable in the making of radiographs. The short distance between the focal spot and film makes it possible to take satisfactory radiographs of the teeth and jaws with a very small expenditure of energy. With a distance of 8 in. between the film and focal spot the photographic effect may be secured with one-fourth the energy which would be necessary if the distance were 16 in. The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C. 4, is the owner of the British patent rights.

A Cable Winding Drum.

The London Electric Firm, Brighton Road, Croydon, has sent us particulars of a drum intended for feeding current to a 3-phase A.C. motor-operated mine-sinking pump, or

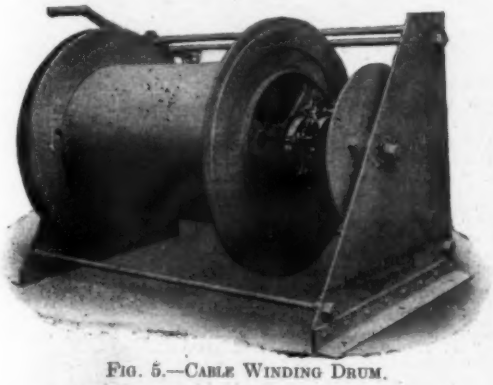


Fig. 5.—Cable Winding Drum.

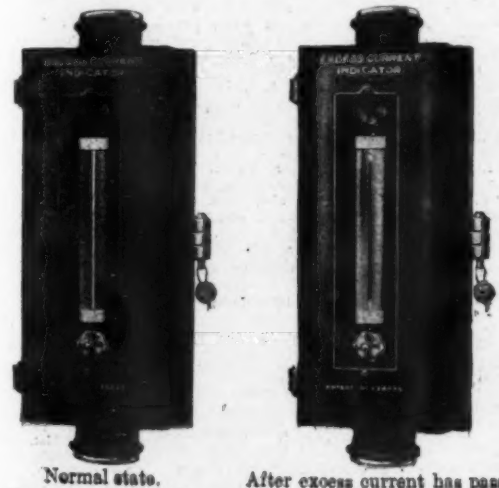
similar service, and in the illustration (fig. 5) the three sets of slip rings and brushes are insulated for 3,000 volts.

The brush gear is totally enclosed and weatherproof. The rings are fixed (the incoming cables being coupled thereto), while the brushes revolve with the drum, suitable connecting clamps being provided for a 3-core cable, which is led from the barrel over a guide pulley to the pump.

The drum accommodates a long length of heavy cable, and is spur geared to give easy winding, provision being made to prevent rotation when desired.

The "Sentinel" Excess Current Indicator.

While the current limiter has been largely used in connection with the supply of electricity to small dwellings, &c., without the use of a meter, it has the characteristic that under no circumstances can the consumer even momentarily exceed his specified maximum demand, though he may be anxious to have that privilege and be quite willing to pay for it. The cost of the current limiter is also continuously increasing. In many other cases it is desired to record the passage of a current stronger than a predetermined value, without actually preventing it; for example, insurance companies specify that machinery insured with them shall not be overloaded, but they have no means of detecting the breach of this proviso. A new device which has been patented by the Electrical and Engineering Development, Ltd., and is about to be manufactured in London by Messrs. Electrical Utilities, Ltd., of 82, Victoria Street, S.W.1, provides a cheap and effective solution to this and similar problems. The device, fig. 6, consists of a cast-iron fuse box containing, instead of a fuse, a suitably graded resistance wire of Eureka or other similar material, coated with crystals of urea. These are normally pure white, and retain that appearance indefinitely unless they are heated above a definite temperature, at which they melt and turn dark brown. The device, therefore, if inserted in an electrical circuit, will show no change until a certain current passes for a few minutes, which may be only 10 per cent. above the normal maximum current in the circuit; but that excess current is still only one-fifth of the current at which the wire fuses, so that there is no risk of the current being cut off by the device.



Normal state. After excess current has passed.

Fig. 6.—The "Sentinel" Excess Current Indicator.

The indicating wire is preferably enclosed in a glass tube, so that a new element can be inserted without risk of damaging the coating; and a glass inspection window is provided in the case, so that the condition of the wire can be seen at a glance.

Other uses besides those to which we have referred will readily occur to the reader. For instance, last week a correspondent inquired for a device which would record the overloading of a transformer, and battery makers maintaining batteries under contract would find the "Sentinel" useful. It can be made to carry any normal current that may be desired, and to change colour at any percentage excess of that current.

NEW PATENTS APPLIED FOR, 1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

19,107. "Voltage regulator." H. Barth. July 7th. (Germany, April 4th, 1919.)

19,108. "Terminal connections of electric dynamos." H. Barth. July 7th. (Germany, April 5th, 1919.)

19,127. "Starting devices for internal-combustion engines." R. Bosch Akt. Ges. July 7th. (Germany, June 4th, 1919.)

19,146. "Electric lighting systems." J. Bethenod. July 7th.

19,159. "Electrostatic separation of finely-divided discrete material." G. R. Brown. July 7th.

19,165. "Arrangement for electrical distance control of valve gear of hydraulic gun-pointing gear." F. Krupp Akt. Ges. July 7th. (Germany, November 27th, 1916.)

19,166. "Arrangement for electrical distance control of valve gear of hydraulic gun-pointing gear." F. Krupp Akt. Ges. July 7th. (Germany, December 4th, 1916.)

19,180. "Electromagnet chuck." F. Krupp Akt. Ges. July 7th. (Germany, June 18th, 1919.)

19,183. "Sparking plugs." H. R. Bellinger and S. Travers. July 7th.

19,188. "Electro-hydraulic steering apparatus." San Giorgio Soc. Anon. Industriale. July 7th. (Italy, September 17th, 1916.)

19,196. "Wireless signalling systems." British Thomson-Houston Co. July 7th. (United States, October 29th, 1913.)

19,197. "Electron discharge devices." British Thomson-Houston Co. July 7th. (United States, October 29th, 1913.)

19,198. "Amplication of electrical variations." British Thomson-Houston Co. July 7th. (United States, November 8th, 1915.)

19,199. "Electron discharge apparatus." British Thomson-Houston Co. July 7th. (United States, June 5th, 1916.)

19,205. "Telephones." G. Seibt. July 7th. (Germany, March 1st, 1916.)

19,222. "Eliminating line resistance losses in electrical apparatus." F. M. Lewis. July 7th.

19,228. "Electric generating apparatus." Silent Valve Motors Corporation. July 7th. (United States, September 15th, 1913.)

19,243. "Electric contact thermostats." Vapor Car Heating Co. July 7th. (United States, January 19th, 1918.)

19,271. "Electric-arc welding." Rail Welding and Bonding Co. July 7th. (United States, January 26th.)

19,304. "Automatic cut-out for electric motors." Vaile-Kimes Co. July 7th. (United States, June 16th, 1915.)

19,331. "Transmitters for wireless telegraphy, &c." Ges für Drahtlose Telegraphie. July 7th. (Germany, July 3rd, 1914.)

19,332. "Cathode-tube generators." Ges. für Drahtlose Telegraphie. July 7th. (Germany, July 15th, 1915.)

19,333. "Wireless telegraph transmission." Ges. für Drahtlose Telegraphie. July 7th. (Germany, December 24th, 1915.)

19,334. "Production of high power currents of constant frequency." Ges. für Drahtlose Telegraphie. July 7th. (Germany, December 31st, 1915.)

19,335. "Telegraphy." Ges. für Drahtlose Telegraphie. July 7th. (Germany, November 9th, 1916.)

19,336. "Electric condensers." Ges. für Drahtlose Telegraphie. July 7th. (Germany, March 6th, 1917.)

19,337. "Wireless telegraph transmitters." Ges. für Drahtlose Telegraphie. July 7th. (Germany, October 20th, 1917.)

19,339. "Arrangement for minimising loss in production of oscillations by means of vacuum tubes." Ges. für Drahtlose Telegraphie. July 7th. (Germany, December 6th, 1917.)

19,339. "Wireless transmitters." Ges. für Drahtlose Telegraphie. July 7th. (Germany December 6th, 1919.)

19,340. "Electric condensers." Ges. für Drahtlose Telegraphie. July 7th. (Germany, March 6th, 1914.)

19,341. "Means for maintaining constant the speed of an electric motor." Ges. für Drahtlose Telegraphie. July 7th. (Germany, February 9th, 1918.)

19,342. "Course and fine adjustment for tuning and coupling devices for wireless telegraph apparatus." Ges. für Drahtlose Telegraphie. July 7th. (Germany, November 10th, 1917.)

19,343. "Arrangement for locating underground, &c., conducting objects." Ges. für Drahtlose Telegraphie. July 7th. (Germany, November 23rd, 1917.)

19,344. "Cathode tubes." Ges. für Drahtlose Telegraphie. July 7th. (Germany, January 29th, 1918.)

19,345. "Method for directive wireless telegraphy with separated antennæ." Ges. für Drahtlose Telegraphie. July 7th. (Germany, June 11th, 1918.)

19,346. "Cathode tubes." Ges. für Drahtlose Telegraphie. July 7th. (Germany, October 10th, 1918.)

19,347. "Electric frequency multipliers." Ges. für Drahtlose Telegraphie. July 7th. (Germany, October 26th, 1918.)

19,348. "Means for signalling to railway trains in motion." Ges. für Drahtlose Telegraphie. July 7th. (Germany, February 4th, 1919.)

19,349. "Wireless receivers." Ges. für Drahtlose Telegraphie. July 7th. (Germany, May 21st, 1919.)

19,350. "Conveyance and distribution of high-frequency electric currents." Ges. für Drahtlose Telegraphie. July 7th. (Germany, May 28th, 1919.)

19,353. "Electric soldering-bits." Blériot, Ltd. July 7th. (France, March 7th, 1918.)

19,361. "Connecting clamp for electric wires." Allgemeine Elektricitäts Ges. July 7th. (Germany, May 11th, 1918.)

19,362. "Oil-break switch." Allgemeine Elektricitäts Ges. July 7th. (Germany, April 1st, 1914.)

19,375. "Electro-magnetic wave-signalling aerials." M. Latour. July 7th. (France, November 11th, 1915.)

19,376. "Thermionic tube amplifying devices." M. Latour. July 7th.

19,377. "Gas relays for coupling electric circuits." Ges. für Drahtlose Telegraphie. July 7th. (Germany, February 9th, 1915.)

19,378. "Telegraphy and telephony signalling systems." Ges. für Drahtlose Telegraphie. July 7th. (Germany, May 28th, 1919.)

19,379. "Electro-magnetic wave-transmission systems." Soc. Francaise Radio-Electrique. July 7th. (France, July 9th, 1919.)

19,380. "Electro-magnetic wave-receiving systems." Soc. Francaise Radio-Electrique. July 7th. (France, May 7th, 1919.)

19,387. "Support for filaments used in thermionic valves, &c." H. Morris-Airey, A. R. Macrorie and S. R. Mullard. July 7th.

19,408. "Means of breaking high-tension electric currents." J. Schuil. July 8th.

19,443. "Electric-current interrupters." C. Zeiss (firm of). July 8th. (Germany, May 28th, 1918.)

19,446. "Apparatus for transmission and reception of pictures, &c., by wireless and land telephones." F. B. Underwood. July 8th.

19,451. "Reversing-switch for electric planing, &c., machines." J. Lennox and R. M. Robertson. July 8th.

19,480. "Controllers for electric motors." Soc. Anon. Constructions Electriques de Belgique. July 8th. (Belgium, March 18th, 1919.)

19,495. "Electric indication of fairways of great lengths." Siemens & Halske Akt. Ges. July 8th. (Germany, December 19th, 1918.)

19,496. "Receiving arrangements for electric detection of fairways of ships." Siemens & Halske Akt. Ges. July 8th. (Germany, December 19th, 1918.)

19,504. "Manufacture of stranded conductors." Siemens-Schuckertwerke. July 8th. (Germany, December 14th, 1917.)

19,512. "Device for strengthening telephone currents, &c." Telegraphon Ges. July 8th. (Germany, April 20th, 1917.)

19,527. "Electro-magnetic chuck." F. Krupp Akt. Ges. July 8th. (Germany, June 23rd, 1919.)

19,529. "Overload switches." F. Krupp Akt. Ges. July 8th. (Germany, May 15th, 1919.)

19,530. "Weight-lifting magnet." F. Krupp Akt. Ges. July 8th. (Germany, May 28th, 1919.)

19,531. "Starters for continuous-current motors." F. Krupp Akt. Ges. July 8th. (Germany, May 14th, 1919.)

19,533. "Apparatus for electrical long-distance control of valve gear of hydraulic gun-mounting mechanism." F. Krupp Akt. Ges. July 8th. (Germany, November 10th, 1917.)

19,534. "Signalling means for submarines." O. von Truppel. July 8th. (Germany, May 29th, 1917.)

19,537. "Electric plug contact arrangement." W. aus den Ruthen. July 8th. (Germany, August 8th, 1918.)

19,539. "Electricity meters." Körting & Mathiesen Akt. Ges. July 8th. (Germany, April 2nd, 1917.)

19,540. "Electricity meters." Körting & Mathiesen Akt. Ges. July 8th. (Germany, December 11th, 1918.)

19,549. "Electrically inducing chemical action." W. J. Rickets. July 8th.

19,560. "Telephone systems." Western Electric Co. July 8th. (United States, February 20th, 1919.)

19,565. "Device for strengthening telephone currents." Telegraphon Ges. July 8th. (Germany, May 14th, 1917.)

19,573. "Electron discharge apparatus." British Thomson-Houston Co. July 8th. (United States, October 16th, 1913.)

19,574. "Electron discharge apparatus." British Thomson-Houston Co. July 8th. (United States, March 20th, 1914.)

19,584. "Electromotors." Frankfurter Maschinenbau Akt. Ges. vorm. Pokorny & Wittekind. July 8th. (Germany, March 18th, 1916.)

19,611. "Continuous-current engine with constant voltage." Keisel & Co. July 8th. (Germany, June 17th, 1918.)

19,636. "Electric generating systems." Kohler Co. July 8th. (United States, August 20th, 1917.)

19,637. "Electric generating systems." Kohler Co. July 8th. (United States, March 2nd, 1916.)

19,682. "Collectors for continuous-current machines." R. Boin. July 8th. (France, October 13th, 1917.)

19,685. "Conducting coils." Ges. für Drahtlose Telegraphie. July 8th. (Germany, October 24th, 1917.)

19,686. "Wireless telegraph transmitters." Ges. für Drahtlose Telegraphie. July 8th. (Germany, September 12th, 1918.)

19,687. "Wave telephone systems." Ges. für Drahtlose Telegraphie. July 8th. (Germany, January 17th, 1919.)

19,688. "Receivers of electric waves." Ges. für Drahtlose Telegraphie. July 8th. (Germany, June 3rd, 1918.)

19,689. "Reception of electric oscillations." Ges. für Drahtlose Telegraphie. July 8th. (Germany, May 2nd, 1916.)

19,690. "Production of high-frequency currents in static transformers." Ges. für Drahtlose Telegraphie. July 8th. (Germany, February 26th, 1914.)

19,702. "Detecting presence in bodies of non-magnetic-material of bodies of magnetic material." G. H. Jackson. July 8th.

19,713. "Combined resistance with hollow conductors." F. Jacoviello. July 8th. (Italy, December 21st, 1917.)

19,749. "Manufacture of electrical insulating-cement." Blériot, Ltd. July 8th. (France, November 8th, 1917.)

19,750. "Electro-magnetic wave navigational or direction-finding systems." Ges. für Drahtlose Telegraphie. July 8th. (Germany, October 23rd, 1918.)

19,757. "Electrical high-frequency current transformers." Ges. für Drahtlose Telegraphie. July 8th. (Germany, July 29th, 1918.)

19,758. "Electro-magnetic wave, navigational or direction-finding systems." Ges. für Drahtlose Telegraphie. July 8th. (Germany, June 3rd, 1918.)

19,759. "Telephone, &c., systems." M. Latour. July 8th. (France, May 23rd, 1919.)

19,760. "Continuous electro-magnetic wave-transmitting system." M. Latour. July 8th. (France, August 16th, 1915.)

19,761. "Thermionic tube amplifying devices." M. Latour. July 8th. (France, November 30th, 1918.)

19,762/3. "Telephone, &c., systems." M. Latour. July 8th. (France, June 25th, 1915.)

19,792/3. "Apparatus for assembling electric switches." J. P. Tucker and J. H. Tucker & Co. July 9th.

19,799. "Armatures for dynamo-electric machines." V. G. Apple. July 9th. (United States, November 19th, 1914.)

19,800. "Terminal bending tools for armatures." V. G. Apple. July 9th. (United States, December 11th, 1916.)

19,801. "Armatures, &c., for dynamo-electric machines." V. G. Apple. July 9th. (United States, December 30th, 1916.)

19,802/3/4. "Commutators." V. G. Apple. July 9th. (United States, January 22nd, 1917.)

19,805. "Armatures." V. G. Apple. July 9th. (United States, January 29th, 1917.)

19,806. "Armatures for dynamo-electric machines." V. G. Apple. July 9th. (United States, January 22nd, 1917.)

19,807. "Starting and lighting apparatus for self-propelled vehicles." V. G. Apple. July 9th. (United States, April 23rd, 1917.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

4,295. "Inductances for wireless telegraphy and allied uses, and the manufacture thereof." E. Russell-Clarke. Complete. Accepted February 4th, 1920. Patent sealed February 4th, 1920. March 23rd, 1916. (145,093.)

1918.

7,735. "Starting devices for internal-combustion engines." O. Imray. (R. Bosh Akt.-Ges.) May 8th, 1918. (145,095.)

1919.

1,012. "Methods and apparatus for signalling and otherwise utilising radiant impulses." R. A. Fessenden. January 14th, 1918. (122,418.)

6,898. "Installations for electrically lighting, heating, and ventilating railway carriages and other vehicles." H. D. Rohman. March 19th, 1919. (145,130.)

7,130. "Electric switching means for preventing the theft or unauthorised use of motor vehicles." L. E. Cowey. March 21st, 1919. (145,132.)

7,174. "Automatic contactors or electrically-operated switches and such-like electrical devices." W. Brooke and E. M. Kerr. March 22nd, 1919. (145,134.)

7,289. "Electric relays, applicable more especially to relays for use in railway signalling apparatus. W. R Sykes Interlocking Signal Co. and R. W. Tarrant. March 24th, 1919. (145,142.)

7,292. "Controlling devices for electric starters for internal combustion engines." F. J. Gill. March 24th, 1919. (145,143.)

7,343. "Electric supply systems for lighting, heating, and ventilating railway carriages and other vehicles." H. D. Rohman. March 24th, 1919. (145,145.)

7,370. "Electric arc welding and cutting." A. Smith. March 25th, 1919. (145,147.)

7,650. "Electrically-driven luggage trucks and the like." H. J. Carey. March 27th, 1919. (145,162.)

8,074. "Method of and apparatus for the transmission of sound waves by means of light and like radiant energy." T. W. Case. March 31st, 1919. (145,169.)

10,018. "Electric lighting systems." D. E. Westcott. April 22nd, 1919. (145,200.)

10,414. "Electrically-operated camera shutters." H. M. Batten. April 26th, 1919. (145,202.)

10,773. "Sparking plugs." A. Lyonnet. April 30th, 1919. (145,208.)

14,167. "Electric fuse holders." Ironclad Switchgear Co. and E. W. Morgan. June 14th, 1919. (145,238.)

14,809. "Fixing frame for securing electric meters, switches, fuses, and the like to walls and partitions." E. A. Welch. June 12th, 1919. (145,249.)

14,877. "Process for the production of plates and sheets by electro-deposition." S. O. Cowper-Coles. June 12th, 1919. (145,250.)

15,269. "Clips for supporting and fixing electric cables and the like." T. S. Jones, W. A. Mortimer, and E. Jones. June 18th, 1919. (145,256.)

17,468. "Electric bell apparatus." A. L. Davis. July 12th, 1919. (145,277.)

17,470. "Electric press-button." A. L. Davis. July 12th, 1919. (145,278.)

19,236. "Switches for use in electric lighting systems." D. E. Wescott. August 5th, 1919. (145,293.)

20,073. "Ignition apparatus for internal-combustion engines." J. Kelly and G. Honestchalger. August 15th, 1919. (145,300.)

20,892. "Electric switches." A. S. Cubitt. August 26th, 1919. (145,303.)

22,391. "Generators of high frequency oscillations for wireless telegraphy." V. J. F. Bouchardon. November 21st, 1918. (135,464.)

23,906. "Antiparasitic receiving and selecting system for telegraphy and telephony with or without wires." L. Levy. October 1st, 1918. (133,306.)

25,290. "Electrical ignition plug." Delta Co. April 29th, 1919. (142,434.)

26,167. "Methods for and apparatus for automatic arc welding." British Thomson-Houston Co. (General Electric Co.). October 24th, 1919. (145,330.)

29,914. "Sparking plugs for internal-combustion engines." A. G. Brown. December 1st, 1919. (145,348.)

31,269. "Electrical connector boxes." M. H. Goldstone. December 13th, 1919. (145,356.)

32,347. "Indicators for electric controlling switches." F. Bechoff. December 24th, 1919. (145,360.)

1920.

1,844. "Electric lighting of automobile vehicles." R. Bosch Akt.-Ges. November 25th, 1918. (138,102.)

1,902. "Clamp for electric wires." J. F. Schleper. January 21st, 1920. (145,368.)

2,830. "Electrical resistance control." L. Hulbert. January 29th, 1920. (145,373.)

3,001. "Windings for dynamo-electric machines. Siemens Bros. Dynamo Works and J. W. Howard. January 31st, 1920. (145,375.)

5,796. "Selecting devices for automatic telephone systems." Siemens Bros. & Co., E. A. Petithory, and J. E. Collyer. February 26th, 1920. (145,377.)

6,977. "Subscribers' instruments for automatic telephone systems." Siemens Bros. & Co. and E. A. Petithory. March 9th, 1920. (145,380.)